

73 Amateur Radio Today

JULY 1992
ISSUE #382
USA \$2.95
CAN \$3.95

A West Publication
International Edition

QRP To Go!

MFJ's New QRP Transceiver

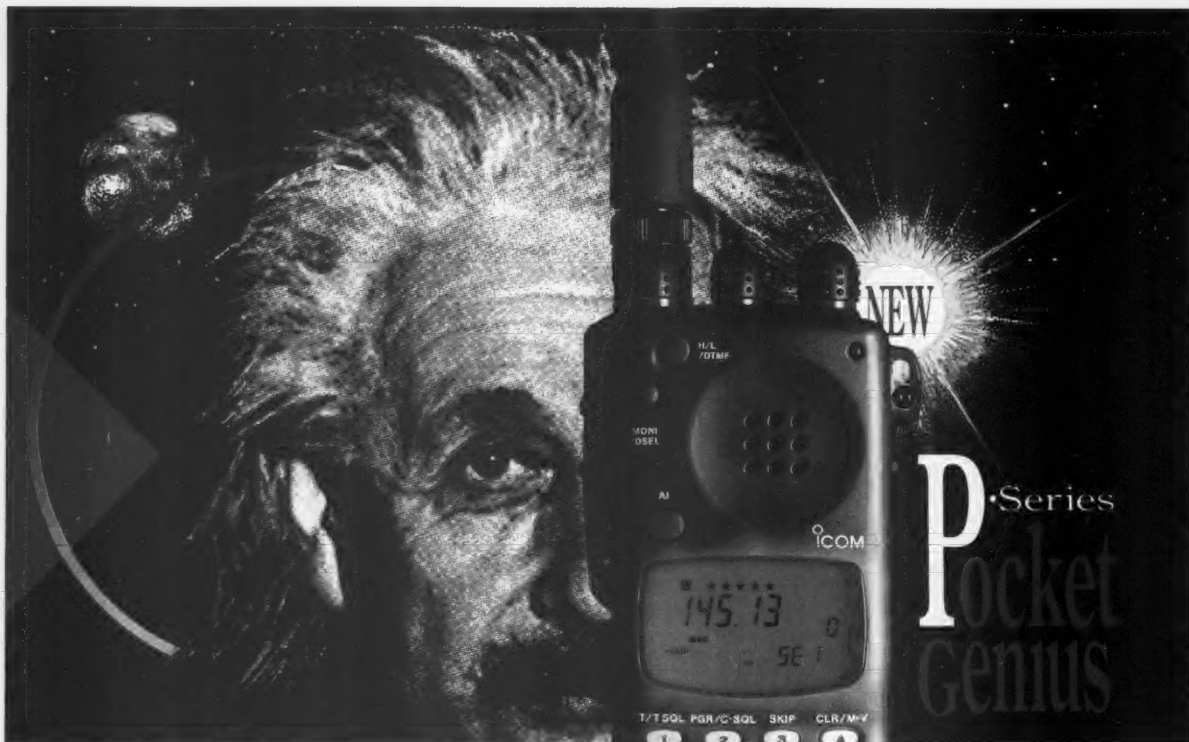
Great Projects to Build

- 10m Transmitter
- Six-Band Antenna
- Indoor Antenna



#BX8KK6F*****5-DIGIT 48103
#SMCR00000099 4#480288 9D
UNIV MICROFILM SAMPLE COPY
SERIAL PRNG ATNLINDA
300 N ZEEB RD #M007
ANN ARBOR MI 48103-1553





The Only Handheld With Artificial Intelligence

ICOM continues to lead the way in communications technology with the first "Smart Radio." Inside its super compact, futuristic body is a micro brain that offers programming, customizing, fun and games never before enjoyed in amateur radio!

The P-Series Pocket Genius actually asks you questions, determines your abilities and provides only the features you can handle. It is the perfect answer for making amateur radio simple and fun for new hams — yet in the hands of an experienced user, will prove to be the most advanced, full featured handheld in history!

The Most Full Featured Handheld Ever Built

ICOM has been listening to your suggestions and has responded with a handheld featuring everything you've ever wanted...and more: **100 Memories** - more than any other handheld. **16 Autodial Memories** - one touch of a button makes your call. **Illuminated Keypad and Display** allows nighttime use. **Large Display** is easier to read. **DC Socket** for charging at home. **Optional DTMF Pager** lets anyone call your handheld with a 3-digit code. **Memory Skip and Mask** allows you to customize memories to be scanned.

P2AT 2 Meters, P3AT 220MHz, P4AT 440MHz.

New Hams in the Family

will appreciate the many easy-to-use features, small size and exciting question-and-answer games. They will have fun learning and advancing with the "Pocket Genius." And with autodial memories, they can have "911" emergency access at the touch of one button!



Be one of the first to experience amateur communications of the 21st century!



Actual Size

The World's Smartest Handheld!

For more information, see your ICOM dealer or call the ICOM Brochure Hotline 1-800-999-9877.

ICOM America, Inc. 2380-116th Ave. N.E., Bellevue, Washington 98004
Customer Service Hotline (206) 454-7819

All stated specifications are subject to change without notice or obligation. All ICOM radios significantly exceed FCC regulations limiting spurious emissions. P2AT192

ICOM

Simply the Best

SHOULD BE ON READER SERVICE CARD

TURN

Simply connect one of our fully automatic phone patches to your base station radio. Suddenly your mobile and HT radios can initiate and receive telephone calls without any assistance.

MODEL CS-700: An economical simplex sampling patch. The operator is in full control at all times. User selectable operating modes: VOX Enhanced Sampling or VOX Controlled Sampling. Features include a 9 Phone number Speed-dialer, Automatic Sample Window Set-up and more.

PRIVATE PATCH V: Offers four user selectable operating modes:

1. Simplex VOX Enhanced Sampling
2. Simplex VOX
3. Semi-Duplex
4. Repeater Maker.

In the Simplex VOX mode, Private Patch V can be used straight simplex or through remotely located repeaters and only requires Mic jack and ext. speaker jack connections to the base radio. Features include a 90 Phone Number Speed-Dialer, Remote Base operation and more. Thousands are in use worldwide.

NEW MODEL CS-800: A low cost patch that operates either Full or Semi Duplex. Plus has built-in Repeater Maker. Use with dual bander radios or connect to your existing repeater for Full Duplex patch. Also turns your radio into a powerful repeater system if desired. Other features include 9 Phone Number Speed-Dialer and more.

MODEL 8200: Includes all features and modes of Model CS-800 plus 90 Phone number Speed-Dialer, Remote Base Mode, DTMF Selective Calling (other tones are optionally available), remotely programmable access codes, and more. (Also available in desk top cabinet). This is the finest Full Duplex Patch/Repeater Controller in the business!!

All Models Also Include: Built-in user programming keyboard with digital readout display (All features and modes are user programmable) • Last Number Redial • Line in use detect • Call Waiting • Automatic 1-800 toll override • User programmable CW ID • Single or Multi-Digit Access/Disconnect codes • Secret Toll Override Access Code • Hookflash • Fully Regenerated Tone or Pulse Dialing • Ringout sounds like a phone • Remotely controllable relay • Non-volatile memory • Lightning protection and the famous one year CSI Warranty. When you compare to brands C or I you will find there's simply no competition.

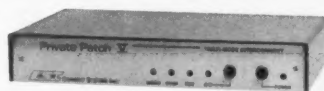
Call or write for brochures and dealer information.



CONNECT SYSTEMS INC.
2064 Eastman Avenue #113
Ventura, California 93003
Phone (805) 642-7184 • FAX (805) 642-7271

CIRCLE 12 ON READER SERVICE CARD

Your Radio Into a Phone



1(800) 545-1349

LETTERS

Number 1 on your Feedback card

Arthur C. Erdman W8VWX, Worthington OH Part of your editorial in the January 1992 issue contained, for the first time in print, praise for the work done by myself and my shipmates. I was one of the instructors in receivers in Radio Material School (USNR-Special Assignment) who "fiendishly" put in bad components to be found by the students. I taught at Navy Pier, Chicago, from 1945 to 1946. At college, they looked down their noses at my experience in Navy electronics.

You hit the nail on the head by saying much of college was not interesting nor to the point. Only in my fifth year did I get anything really interesting. It was the detailed study of TV receivers.

I've retired from electronics and now am helping my oldest son in his financial business (CPA). With three computer systems, he can do much more work in a shorter time period. Ham radio is not the only group with old fogies—some CPAs absolutely refuse to learn how to operate the computer systems. They are being left behind.

Keep blasting hams to "shape up—ship out."

Joseph P. Esposito N2NSO, Bronx NY I really enjoy reading *73 Magazine*. I look forward to the next issue each month. I am responding to WASBMN's comments [*Letters, January 1992*] about contesting on the amateur bands, especially 10 meters.

I am a Tech and my phone privileges, as you know, are a small spectrum of the amateur bands. I am a radio warrior on the weekends and look forward to working DX. But when I get home on Friday night from work, fire up the radio, and I hear "CQ contest," I shut down and I work my 2 meter radio.

I have to agree with WASBMN: I do like using my radio equipment on the weekends; HF, that is.

Bill Strickland KC4CUM, Huntsville AL I have been reading your magazine for several years and think it is by far the best that I have ever seen. Your ideas and proposals about radio, morals, and enthusiasm are always refreshing and uplifting.

It was only recently that I discovered that you were a member of the silent service and on the *USS Drum*. I have fond memories of a favorite uncle Roy B. Hester who was on several of the old pig boats and later made 13 patrols on the *USS Nautilus* as Chief Electrician's Mate, including the Battle of the Coral Sea and Midway.

Thanks for the influence you continue to have on your readers.

Dick Melcher WA6MDI You talk about the 14.313 mess. Well, I ran into the same kind of thing when I moved into the Rogue Valley 18 months ago. I was interested in having a 440 MHz input and a 2m output remote base. Some of the local "powers" got wind of this and started bad-mouthing me. At the local radio club I was asked, "Who do you think you are, coming up here from California and doing this in our valley?" Seems that a group feels that 2m is

From the Hamshack

for rag-chewing and that packet, repeaters and, most of all, autopatchers, have no use on their band. So I put up a 440 MHz repeater to control an ICOM 735 with an Ultra-Com Shack 64 and an AT-150 auto antenna tuner. I've already got a half dozen users, including a blind man and some users in retirement manors where outside antennas are not allowed.

Anyone else doing this? This is a great service for hams in poor locations and I'd like to see more like this. Dick, if we lose amateur radio, it'll be your grouching retrograde neighbor hams who have killed the hobby, not you . . . Wayne

Garry Neill K4FRL, Acworth GA I met you about 20 or 25 years ago in the hospitality room at the Atlanta Radio Club Hamfest. I knew that you were a "maverick" from what I had been told. But, I found that I liked what you said. I have since agreed with your philosophy and your ideals. Please, keep prodding me (hams) and the other groups that you are working with.

I haven't followed your exhortations to the extent that I should, but I enjoy your continuing to encourage me on to greater accomplishments. You have my backing for any idea or project that you have. I can say that, based on my reading your writings for the past 20+ years, you have been "right on target." Keep up the good work.

Jim Travis AC4JJ, Nashville TN Agreeable or disagreeable, your editorials are provocative, more often on target than off. Practical or not, you generate volumes of ideas. Ideas are the lifeblood of creativity. What makes you uncommon is that you act on your ideas and often succeed. When others act on your ideas, good things can happen.

For more than 20 years my ham license, WB4HNS, was rarely used. In the mid-'60s some excellent Army instructors at Fort Dix, NJ, taught me code. These guys could strap on a leg key and bat code back and forth and never take a note. It was made clear that if you didn't learn, you would be backpacking in the snow on the other side of the post—the Army's answer to incentive licensing, I guess.

Near the end of Army service, two sergeants at Ft. Polk, one an ex-Western Union telegrapher, introduced me to ham radio at the MARS station to which I'd just been assigned. They administered the Novice exam. Picture yourself as a Novice sitting before a Collins S-line console, courtesy of Uncle Sam, with beams, an inverted-V, a long dipole, most of the operating time you could want, and a couple of fine operators right there to learn from. Few Novices are ever so lucky.

After Army service I upgraded to General class, used a 75 watt crystal CW rig for awhile, then all but quit the hobby. Excuses: apartments and a condo with no antenna space, career demands, family expenses, no decent equipment, never hearing much on 2 meters for which I DID have gear.

The license would be renewed, ham magazines read, a few projects built. I

would call on 2 meter FM but get little out of it. Computers became a serious hobby.

The old Elco CW rig gathered attic dust beside a Heath SB-300 receiver, its crystals removed and employed in a home-brew shortwave converter for the car.

A few years ago I began paying attention to your jarring editorials. Your message to me was and still is: Got a license? Use it or lose it. Same goes for valuable chunks of radio spectrum.

One day colleagues at work invited me under their 1990 Field Day tent. That day the fire was lit and refused to go out. Soon I found an affordable used HF rig, some Hustler coils and a modern 2m HT, figuring if I can't put up an antenna where I live, I'll go mobile.

One hundred ten countries, 50 states, a thousand QSOs and two quick upgrades later I am still mobile. In front of me are two prized original cards that arrived today from mobile contacts with Jordan and Antarctica. Am I enjoying the heck out of this? You bet.

Last year I signed on with Army MARS, the local radio club, and QCWA—met some great people, contribute as work permits, proselytize a lot about ham radio but itch for more. Satellites and the upper spectrum have yet to be explored. If there is a way to work those mobile, believe me I will find it.

This hobby is, as Robert Louis Stevenson put it, "so full of things we should all be happy as Kings." There is no end to the challenges, no limit on our frontier.

Had you not been such a nag all these years, Wayne, I would not be writing to thank you.

There are, in fact, many to thank, beginning with the two sergeants whose names and calls I wish I could track down. They must now be close to retirement.

Above all, I will remember a young 11-year-old worked in a contest over a year ago. In a few short months he had gone from no license to Advanced. With his father's obviously able help he was preparing to march on Extra. If HE could do it, so could a 49-year-old. A few months later I walked out of a VE session as /AE awaiting a new call.

Our hobby faces serious problems and challenges. Perhaps the new people enticed by no-code licensing will show the way. We need the new blood. Most no-coders I run across will be credits to the hobby. Most already are at work on upgrades, some with remarkable dedication.

What is nice to know as I meet people on the bands is that this rejuvenated interest is NOT unique. Many have followed similar paths. Invariably we regret the time away from ham radio. We are glad to be back.

I hope more of us read and re-read David Cassidy's February 1992 piece on how to generate a QSO conversation. It is important. As a journalist, an interviewer who enjoys extended QSOs with the interesting people of our hobby, be assured the techniques work. David's article could be Lesson 2 in any operating manual, Lesson 1 being how to tune up quietly.

The points he makes were driven home for the first time by a ham visiting here from Kentucky, a minister, active on 2 meters. This gentleman never really said much in his QSOs on a local repeater. He didn't have to. He asked questions, made observations. He drew people out. Many interest-

ing experiences and a few life stories were told in those QSOs. He was absolutely the best and brought out the best in his contacts.

Keep those editorials, fine columns and concise construction articles coming. Most of all, thank you for your prodding. Don't ever let up.

John Seginski N7NV, Reno NV Wayne, first of all, I think you're crazy. Or mightly eccentric to say the least. And that is no insult, believe me. I've been reading your editorials since way back when you first started *73 Magazine*.

I'm glad you're crazy. That's why you've accomplished so much in your life. I don't think "normal" humdrum people accomplish anything, especially in the technical fields.

The reason I'm writing is because I think you're too hard on some of the old modes of operating, like CW and AM. I've recently got back on 10 meter AM (popular AM window, 29.0 to 29.2 MHz) using a Johnson Ranger and a Collins 75A4 and have been having a really good time. I can call CQ and meet a lot of new friends, and we talk for hours about the technical aspects of the old rigs. Sort of reminds me of the fellows I know at the classic car club when they get together to discuss the pros and cons of whether a straight 6 engine is any better than a V8, or vice versa, in their old cars. In the classic car club we never talk against the guys who own and drive the old cars.

And I'll bet when you were in your Porsche club you didn't talk against the fellows who owned and drove the old Speedsters, did you? You probably talked with them about the characteristics of their old cars even though they weren't state of the art. Why can't you afford the same courtesy to the hams who enjoy the old modes of communication? Remember: Ham radio is supposed to be fun, regardless of what mode is being used.

You won't find many hello/good-bye QSOs on 10 meter AM phone. Some of the guys (old and young) can literally talk your ears off. They don't use VOX and when they are talking, they have the podium.

Take a listen. I think you'll be pleasantly surprised, and get yourself that old boat anchor rig you dreamed about when you were young, but couldn't afford, and get on the air. I'd like QSOing with you.

Using old classic modes like CW and AM does not detract from the modern modes of operation. I still love SSB, packet, FM, TV, etc., but I do stay off VHF and UHF because every time I get on, all I hear is people clicking their HT transmit buttons and invariably someone will come on and say, "Could you stop transmitting? You're tying up the frequency." That's not the type of ham radio operation I care for.

And CW. If you run high power, I agree it could be detrimental to your health. But you really don't need much power when the band you're using is open. There's nothing more relaxing than clicking away on the old Vibroplex on Saturday mornings on good old 40 CW.

We should all enjoy all the great aspects of ham radio. All modes and all bands. They all have their advantages and disadvantages, and they are all fun.

So lighten up Wayne. Have fun, and I hope to see you on good old 10 meter AM.

THE TEAM

PUBLISHER/EDITOR

Wayne Green W2NSD/1

ASSOCIATE PUBLISHER

David Cassidy N1GPH

MANAGING EDITOR

Bill Brown WB8ELK

PRODUCTION EDITOR

Hope Currier

EDITORIAL ASSOCIATES

Sue Jewell

Joyce Sawtelle

CONTRIBUTING EDITORS

Mike Bryce WB8VGE

David Cowhig WA1LBP

Michael Geier KB1UM

Jim Gray W1XU/7

Chuck Houghton WB8IGP

Arnie Johnson N1BAC

Dr. Marc Leavay WA3AJR

Andy MacAllister WA5ZIB

Joe Moell K0OV

Carole Perry WB2MGP

ADVERTISING SALES

REPRESENTATIVES

Dan Harper

Louise O'Sullivan

ADVERTISING COORDINATOR

Sue Colbert

1-603-924-0058

1-800-274-7373

FAX (603) 924-8613

GRAPHIC DESIGN

Rachel Timper

GRAPHIC SERVICES

FilmWorks, Inc.

Hancock NH

Sim's Press, Inc.

Peterborough NH

TYPESETTING

Linda Drew

CIRCULATION MANAGER

Harvey Chandler

To subscribe: 1-800-289-0388

WAYNE GREEN, INC.

Editorial Offices

70 Route 202N

Peterborough, NH 03458

603-924-0058, FAX (603) 924-8613

Subscription Services

1-800-289-0388

Colorado/Foreign Subscribers

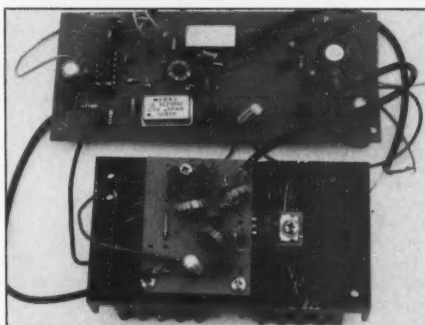
call 1-303-447-9330

Reprints: The first copy of an article \$3.00 (each additional copy—\$1.50). Write to 73 Amateur Radio Today, 70 Route 202N, Peterborough, NH 03458.

73 Amateur Radio Today

July 1992
Issue #382

TABLE OF CONTENTS



Build a 10 meter voice transmitter... see page 18.

FEATURES

- 8 An Indoor or Window-Mounted Vertical Dipole**
A floor-to-ceiling antenna for 10-20m.....W3JIP
- 14 Six-Band Linear Trap Antenna**
Multi-band operation without coils or capacitors.....KB4ZGC
- 18 10 Meter DSB Transmitter**
Easy to build and no tuning required.....WA4ADG
- 26 Calibrated Signal Generator**
An accurate RF source from 400 kHz to 33 MHz at the twist of a dial.....N2DCH
- 32 A Receive Converter Adapter for 2 Meter Transceivers**
Monitor 6 meters or 220 MHz with this unique circuit.....W3RW
- 40 An Eight Channel A-to-D Converter for Your Computer**
Sample the analog world with this easy interface.....N8KDD
- 50 Protected AC Outlet for the Workbench**
Avoid a shocking experience.....N4TMI

REVIEWS

- 36 The MFJ-9020 20 Meter CW Transceiver and Integrated CW Station**
A versatile and portable QRP combo.....WB8VGE
- 46 The Yaesu FT-415 Handheld**
A full-featured 2m mini-HT.....KB1UM

Cover: QRP and camping... a great summertime combination! See our review of MFJ's new QRP rig on page 36. Cover photo by David Cassidy N1GPH.

FB

Editorial Offices

70 Route 202N

Peterborough NH 03458

phone: 603-924-0058

Advertising Offices

70 Route 202N

Peterborough NH 03458

phone: 800-274-7373

Circulation Offices

70 Route 202N

Peterborough NH 03458

phone: 603-924-0058

DEPARTMENTS

- 62 Above and Beyond
- 73 Ad Index
- 70 Ask Kaboom
- 56 ATV
- 84 Barter 'n' Buy
- 60 Circuits
- 85 Dealer Directory
- 17 Feedback Index
- 52 Ham Help
- 80 Hams with Class
- 53 Hamsats
- 54 Homing In
- 2 Letters
- 4 Never Say Die
- 74 New Products
- 88 Propagation
- 78 QRP
- 7 QRX
- 88 Random Output
- 79 RTTY Loop
- 82 73 International
- 66 Special Events
- 86 Uncle Wayne's Bookshelf
- 58 Updates

FEEDBACK... FEEDBACK!

It's like being there—right here in our offices! How? Just take advantage of our FEEDBACK card on page 17. You'll notice a feedback number at the beginning of each article and column. We'd like you to rate what you read so that we can print what types of things you like best. And then we will draw one Feedback card each month for a free subscription to 73.

Manuscripts Contributions in the form of manuscripts with drawings and/or photographs are welcome and will be considered for possible publication. We can assume no responsibility for loss or damage to any material. Please enclose a stamped, self-addressed envelope with each submission. Payment for the use of any unsolicited material will be made upon publication. A premium will be paid for accepted articles that have been submitted electronically (CompuServe ppn 70310.775 or MCI Mail "WGEPUB" or GENie address "MAG73") or on disk as an IBM-compatible ASCII file. You can also contact us at the 73 BBS at (603) 924-9343, 300 or 1200 baud, 8 data bits, no parity, one stop bit. All contributions should be directed to the 73 editorial offices. "How to Write for 73" guidelines are available upon request. US citizens must include their social security number with submitted manuscripts.

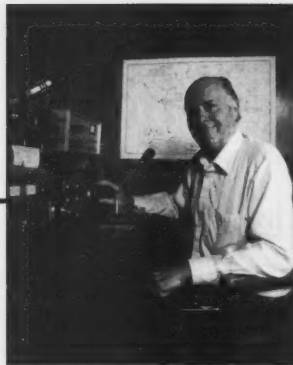
73 Amateur Radio Today (ISSN 1052-2522) is published monthly by Wayne Green Inc., 70 Route 202 North, Peterborough, New Hampshire 03458. Entire contents ©1992 by Wayne Green Inc. No part of this publication may be reproduced without written permission from the publisher. For Subscription Services write 73 Amateur Radio Today, PO Box 58866, Boulder, CO 80322-8866, or call 1-800-289-0388. In CO call 1-303-447-9330. The subscription rate is: one year \$24.97; two years \$39.97. Additional postage for Canada is \$7.00 and for other foreign countries, \$19.00 surface and \$37.00 airmail per year. All foreign orders must be accompanied by payment in US funds. Second class postage paid at Peterborough, New Hampshire, and at additional mailing offices. Canadian second class mail registration number 9566. Canadian GST Registration #125393314. Microfilm Edition—University Microfilm, Ann Arbor, MI 48106. Postmaster: send address changes to 73 Amateur Radio Today, PO Box 58866, Boulder, CO 80322-8866.

Audit Bureau of Circulations (ABC) membership applied for.

Contract: By reading this fine print, you have just become legally and morally obligated to the Team at 73 to share this copy of 73 with one of the few misguided fools who doesn't already subscribe. Point out the folly of his ways and give him the subscription card.

NEVER SAY DIE

Wayne Green W2NSD/1



Flea Markets

The great cry from builders has to do with finding parts. You can't build much if you have to rely on Radio Shack for all your parts. And you're limited if you have to depend entirely on equipment that's available in parts kits. So how can you find the parts you want? Well, they're all there by the zillions in the larger flea markets. The only problems are (a) getting to a big enough flea market to find what you need, (b) actually finding your needs in a reasonable length of time, and at the price you want, and (c) getting the parts when you need them and not six months before or after.

Even the humongous flea market at the Dayton Hamvention doesn't help you if you get the bug to build in June or September. How can you even guess in April that you're going to want to build something in September?

The logical answer to this is to get the flea market exhibitors to advertise their stuff somewhere in a magazine or catalog. Just why hundreds upon hundreds of flea market exhibitors are so blind to the wonders of mail order is a puzzle. I love mail order.

Heck, I started my first mail order business when I was 12 years old and did well at it. That was the Elm Stamp Company. I ran across some of my old ads in a scrapbook recently.

Mail order makes it so you can reach people anywhere in the country and let them know what you've got. Yes, you have to learn about advertising and you have to be merciless in keeping track of which ads and publications pull best for which products. But it sure is nice to see those post office buckets of mail coming in every day, all with checks and charge card info in them. And it's great to have your phone ringing with orders day and night.

I'm selling CDs by mail order through Music/NH. We're also selling book and code tapes through Uncle Wayne's Bookshelf. My wife sells how-to-dance videos and her phone rings with orders day, night and on weekends. Does this bother me? Nope, when she's not around I write

down the orders for her and she has them shipped the next day. I love mail order.

I started my Radio Bookshop back in 1958, selling books to hams. It's still going, now called Uncle Wayne's. Lordy, that's 34 years!

If you have any ideas on how to get the hundreds of flea market vendors to get into mail order, please let me know. I'd love to be able to buy things from them the next time the building bug bites. By the time I get to Dayton I'm too busy networking with manufacturers and talking to readers to properly shop the flea market. There's just too much to do in two and a half days.

Perhaps a special advertising section in 73 would help. We might be able to do that two or three times a year to see how it works. How about a "Ham Radio Marketplace" supplement a couple times a year that we send only to subscribers? Heck, we could include it for our *Radio Fun* subscribers too. That would give it a very good circulation.

Let me know if this is something you'd like to see.

Helping Kids

There's a lot of handwriting about the sad state of our youngsters. They're not getting interested in science and math—they're not reading—heck, they can't even talk very well, like. Yes, I agree that our educational system is at fault. It's been shown to be one of the worst in the developed countries. And yes, I have a bunch of ideas on ways to get it turned around.

My proposals for change are radical. They have to be, because all of the efforts to just improve education have failed. In the almost 10 years since the *A Nation At Risk* report billions have been spent trying to improve the system. What they've found is that the system doesn't need fixing, it needs re-inventing.

Now, my question is this. How interested are you in helping to do something about this mess? I've done a lot of homework and have come up with some proposals for a completely new educational system—one I think you're going to like. But just proposing the changes

means little—the tough part is getting them implemented. That's going to take some work and clout. Are you into work? Have you any clout? Connections?

Starting From the Beginning

After a good deal of research, plus some thinking, the whole miserable picture of how badly we've been messing up our children finally dawned on me. Oh, I suspected, but I figured I must be wrong. We wouldn't do that to our kids! Well we have and are—and it's going to continue unless you and I are able to stop it.

First, I hope you took the time a couple of years ago to watch a PBS movie called "7-14-21-28." It was a film showing interviews with seven-year-old British kids. They asked them what they thought they might do in life. Then they interviewed them again at 14 to see how their lives had progressed by the time they were in their teens. Again they discussed their plans and interests. The third set of interviews with the kids was when they were 21. Now we could really begin to see how firmly their lives had been set when they were seven. The last interviews were when they were 28. This showed even more clearly how well established lifetime patterns are set by seven years old. The film will be shown again soon, complete with interviews at 35 years of age. Don't miss it.

Now we can see that those psychologists have been right who have been claiming that by the time children get into school their minds are already closed to reading and intelligent speech. It makes sense if you know anything about how living things develop. If you interfere at any one stage of development, the whole organism is thrown out of kilter and can never really recover.

With babies we know that without adequate stimulation at the right time the brain fails to build the neuron networks needed to speak, read, and even think very well. Enter Big Bird, who turns out to be a much greater ogre than ever imagined. Yep, "Sesame Street" comes on a villain. Both day care centers and parents have been using "Sesame Street" to keep children sedated. Well, it's great

for that. It hypnotizes them with flashing lights and constant action, but it doesn't provide the stimulation children need to build the neuron network in their brains which is involved with dealing with language and thinking. The result is kids that schools are unable to reach—kids without brains developed enough to handle reading, kids with short attention spans who are used to instant gratification, kids who get bored easily and have few enthusiasms or even much of an interest in learning.

The really awful part of this is that once the time has passed for the child's brain to develop during this part of the normal growth cycle, there is no way to completely repair the damage. Children grow their minds and bodies step by step. When a step is skipped or mangled, it's mangled permanently. And that's what's happening when we should be reading to our children. We fared better a couple of generations ago when we listened to the radio. That called for building pictures in our minds—our brains got some work to do and were not fed visual pap, with nothing lasting more than a few minutes. Is it any wonder kids have such short attention spans and find books boring?

Parents who are just too busy to read to their children should at least invest in some children's stories on tape—and I don't mean Dr. Seuss either. My mother read to me while I ate lunch every day. As soon as I learned to read I was hard at it, reading and re-reading the Oz books. I also loved the poetry of Robert Louis Stevenson and Eugene Field, and could recite much of it.

By 10 years old I'd read all the Tom Swift and Tarzan books, Booth Tarkington, Mark Twain, books on flying, and I even loved what few space travel books there were. So when's the last time you read to your children or grandchildren? If they've been poisoned by "Sesame Street" it's probably too late. I've been planning on making some tapes of me reading the Oz books, but maybe I'm ahead of my time again.

If we want kids to get interested in science and amateur radio, they're going to have to be able to read and think. They're going to have to be able to set goals and achieve them. We need these kids as amateurs to carry on for the next generation. We need them to keep our hobby from being blown away by commercial

interests. But most of all we need them as potential high-tech career scientists, engineers and technicians to help protect our quality of life in the next century.

Let's say that you're not being your usual contentious self and, for a change, you're agreeing with me. The logical question then is, what can I do about the situation? Heck, I'm just one person. Yep, you're one person—and so am I—and so are a hundred thousand other 73 readers.

Continued on page 76

KENWOOD

Our new TS-850S just made the competition obsolete

No competition class transceiver is even in the same ballpark as the TS-850S.

You'll find a superior intermodulation dynamic range of 108 dB throughout the entire 100 kHz to 30 MHz range.

Kenwood's optional DSP-100 Digital Signal Processor (DSP) converts audio signals to digital information, where it is shaped and processed by a microprocessor. For SSB work, this means a cleaner signal, and for CW, it allows adjustment of the rise and fall times for optimum waveshape. The DSP-100 also works at the

receiver detector level for audio shaping, in all modes.

Other advanced technology in the TS-850S includes 10 Hz step dual VFOs, multi-mode scanning, full and semi break-in CW, superior interference reduction, keyer, dual noise blanker, and RIT/XIT. 100 memory channels store, transmit, and receive frequencies independently. High boost for SSB signal "punch." Microphone supplied.

The Kenwood TS-850S. All band. All mode. One year warranty. In a class by itself!

Key options.

DSP-100 Digital Signal Processor.

AT-300 160-10 m external antenna tuner.
AT-850 160-10 m internal antenna tuner.
DRU-2 Internal digital recording unit.
IF-232C Computer interface. PG-2X DC cable. PS-52 Power supply. SO-2 TCXO. SP-31 Matching external speaker.
VS-2 Voice synthesizer. YG-455C-1 500 Hz CW filter for 455 kHz IF. YG-455CN-1 250 Hz CW filter for 455 kHz IF. YK-88C-1 500 Hz CW filter for 8.83 MHz IF. YK-88CN-1 270 Hz CW filter for 8.83 MHz IF. YK-88SN-1 1.8 kHz SSB filter for 8.83 MHz IF.

KENWOOD U.S.A. CORPORATION
COMMUNICATIONS & TEST EQUIPMENT GROUP
P.O. BOX 22745, 2201 E. Dominguez Street
Long Beach, CA 90801-5745

FREE
HS-5 Headphone
with purchase!
A \$67.⁹⁵ retail value.
See your Kenwood dealer
for details.



Kenwood models or exceeds as specified. Contact your dealer for a complete listing of specifications and accessories. Specifications are subject to change without notice. Complete service manuals are available for all Kenwood transceivers and most accessories. *One year warranty in the U.S.A. only.

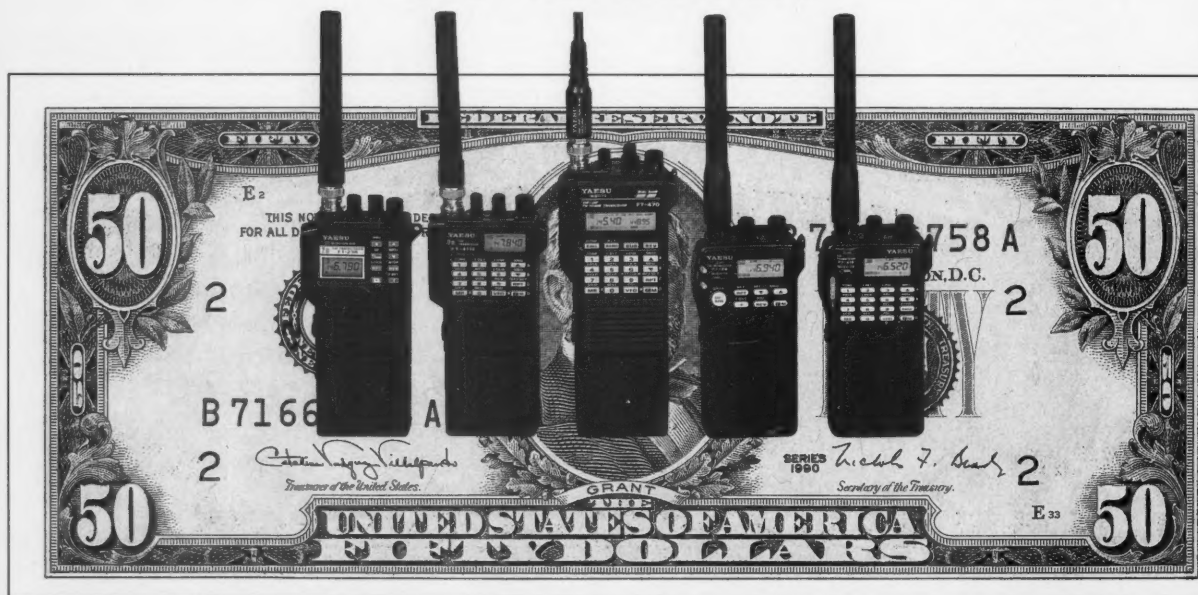
KENWOOD

...pacesetter in Amateur Radio.

YAESU HANDHELD TRADE-UP DAYS!

OFFER EXPIRES
AUGUST 31, 1992

Out with the old
in with the new!
And, get \$50 off
from the folks
at Yaesu!



Take your old amateur handheld* – any brand – working or not – to your authorized Yaesu amateur dealer and get \$50 off the purchase price of any new Yaesu amateur handheld model. Right then and there! No coupons to send in – no rebates to wait for! \$50 offer is limited to purchase of handhelds only and must be used at time of purchase. Sorry, no cash payments. Offer

may not be used with any other Yaesu discount or promotion and is non-transferable. Limit (1) one trade-up per person. Valid at all Yaesu U.S.A. and Canadian dealers only.

So, hurry – act today! Just drop off the "old" and leave with the NEW – with \$50 off from the folks at Yaesu!

This offer expires August 31, 1992.

*Mail order purchases: Call your Dealer for instructions.

YAESU

Performance without compromise.SM

Father Moran, 9N1MM, Silent Key

Marshall Moran SJ, better known to the amateur community as Father Moran 9N1MM, passed away in New Delhi, India, on April 15, 1992, of heart problems. He was 86 years old.

Father Moran's amateur radio career spanned the history of the hobby, from his first crystal radio in 1918 to his daily appearances on 20 meters (even within days of his death). Although he never held a U.S. amateur license, he was active on the bands from Chicago in the 1920s.

In 1951, Father Moran moved to Nepal to establish the St. Xavier School in an abandoned maharajah's summer palace. He remained there for 40 years. In 1960, he asked for and received the first amateur radio license in Nepal, 9N1MM.

Father Moran made almost 300,000 contacts from Nepal and assisted essentially every visiting ham to get on the air. [Ed. Note: Father Moran holds a special place in my DXing memories; my first DX contact was with 9N1MM - WB8ELK]

While not on the air, Father Moran ran the St. Xavier school with its 260 students. He held morning sick call, despite his lack of formal medical training, and he worked tirelessly to improve the education and spiritual well-being of two generations of Nepalese.

Rest in Peace, 9N1 Mickey Mouse. *TNX to the DX Bulletin, April 24, 1992.*

FCC Begins License Revocation Proceedings

The FCC has targeted the amateur Extra class operator licenses of Sandra V. Crane N6TFO (Marina Del Rey, California) and Charles P. Pascal WB6CIY (Culver City, California) for suspension and has begun revocation proceedings. Crane and Pascal were the operators of the California Amateur Radio School in Los Angeles.

Charles Pascal was previously separated from the W5YI-VEC testing program in 1986 when there was a question as to whether his PNP Amateur Radio School might be a profit-making venture. The policy of the W5YI-VEC—which every VE must agree to—is that none of its volunteer examiners may be in the amateur radio business, defined as charging amounts above out-of-pocket expenses. This differs from FCC conflict-of-interest rule 97.515(b) which precludes examiners from manufacturing, preparing or distributing amateur equipment or license preparation material.

Pascal's request to become a VEC in 1988 was denied by the Commission.

Sandra Crane N6TFO was discredited as a volunteer examiner in May 1991 after it was concluded that the \$150 tuition charged by the California Amateur Radio School for a four-hour amateur radio training course conflicted with W5YI-VEC policy. On April 24, the FCC designated both Crane's and Pascal's operator license for suspension and ordered them to show cause why their station license should not be revoked.

"If either respondent requests a hearing or submits a written statement concerning the suspension, that respondent's suspension will be held in abeyance until the matter is decided. If either respondent does not request a hearing or submit a written statement, that respondent's suspension

will take effect 30 days after his or her receipt of this order."

The "Show Cause" order states that the matter will be decided on six issues:

(1.) whether the respondents assisted other persons to obtain amateur operator licenses by fraudulent means;

(2.) whether Sandra Crane improperly examined her daughter for amateur radio licenses;

(3.) whether Charles Pascal improperly participated in the examination of Sandra Crane's daughter on November 12, 1990;

(4.) whether the respondents are qualified to remain a Commission licensee;

(5.) whether one or both station licenses should be revoked; and,

(6.) whether suspension of one or both operator licenses should be affirmed, modified or dismissed.

It has not yet been determined what FCC action will be taken against the volunteer examiners who may have been involved. *TNX W5YI Report, Volume 14, Issue #10, May 15, 1992.*

KV4FZ: Guilty of Telephone Toll Fraud

St. Croix ham operator Herbert L. "Herb" Schoenbohm KV4FZ has been found guilty in federal court of knowingly defrauding a Virgin Islands long-distance telephone service reseller. He was convicted April 24th of possessing and using up to 15 unauthorized telephone access devices in interstate and foreign commerce nearly five years ago.

The stolen long distance telephone access codes belonged to the Caribbean Automated Long Lines Service, Inc. (CALLS) of St. Thomas, U.S. Virgin Islands. Schoenbohm was found to have made more than \$1,000 in unauthorized telephone calls—although the prosecution said he was responsible for far more.

According to the *Virgin Islands Daily News*, Schoenbohm, who is also the St. Croix Police Chief of Communications, showed no emotion when he was pronounced guilty of the charges by a 12 member jury in U.S. District Court in Christiansted. The case was heard by visiting District Judge Anne Thompson.

Neither Schoenbohm nor his defense attorney, Julio Brady, would comment on the verdict. The jury deliberated about seven hours. The sentencing, which has been set for June 26, 1992, will be handled by another visiting judge not familiar with the case.

Schoenbohm, who is Vice Chairman of the V.I. Republican Committee, has been released pending sentencing, although his bail was increased from \$5,000 to \$25,000. While he could receive a maximum of 10 years on each count, Assistant U.S. Attorney Alphonse Andrews said Schoenbohm probably will spend no more than eight months in prison since all three counts are similar and will be merged.

Much of the evidence on the four-day trial involved people who received unauthorized telephone calls from KV4FZ during a 1987 period recorded by the CALLS computer. Since the incident took place more than five years ago, many could not pinpoint the exact date of the telephone calls.

The prosecution produced 20 witnesses from

various U.S. locations, including agents from the Secret Service, the U.S. Marshal's Service, Treasury Dept. and Federal Communications Commission. In addition, ham operators testified for the prosecution.

Schoenbohm was portrayed as a criminal who had defrauded CALLS out of hundreds of thousands of dollars. Schoenbohm admitted using the service as a paying customer, said it did not work and that he terminated the service and never used it again. He feels that there was much political pressure to get him tried and convicted since he had been writing unfavorable articles about Representative DeLugo, a non-voting delegate to Congress from the Virgin Islands, including his writing of 106 bad checks during the recent rubergate scandal.

Most, but not all, of the ham operators in attendance were totally opposed to KV4FZ. Bob Sherrin W4ASX, from Miami, attended the trial as a defense character witness. Sherrin told us that he felt the conviction would be overturned on appeal and that Schoenbohm got a raw deal. "They actually only proved that he made \$50 in unauthorized calls but the jury was made to believe it was \$1,000."

Schoenbohm's attorney asked for a continuance due to newly discovered evidence but that was denied. There also is a question as to whether the jury could even understand the technology involved. "Even his own lawyer couldn't understand it, and prepared an inept case," Sherrin said. "I think he was railroaded. They were out to get him. There were a lot of [ham] net members there and they were all anti-Herb Schoenbohm. The only people who appeared normal and neutral were the FCC. The trial probably cost them a million dollars. All his enemies joined to bring home this verdict."

Schoenbohm had been suspended with pay from his police department job since being indicted by the St. Croix Grand Jury. His status will be changed to suspension without pay if there is an appeal. Termination will be automatic if the conviction is upheld. Schoenbohm's wife was recently laid off from her job at Pan Am when the airline closed down. Financially, it could be very difficult for KV4FZ to organize an appeal with no money coming in.

The day after the KV4FZ conviction Schoenbohm, who is the Republican Committee vice chairman, was named at a territorial convention as one of eight delegates to attend the GOP national convention in Houston this August. He was nominated at the caucus even though his felony conviction was known to everyone. Schoenbohm had even withdrawn his name from consideration since he was now a convicted felon.

The *Virgin Island Daily News* later reported that Schoenbohm will not be attending the GOP national convention. "Schoenbohm said he 'came to the conclusion that my remaining energies must be spent in putting my life back together and doing what I can to restore my reputation. I also felt that any publicity in association with my selection may be used by critics against the positive efforts of the Virgin Islands delegation.'"

Schoenbohm has been very controversial and vocal on the ham bands. Some ham operators now want his amateur radio license pulled—and have made certain that the Commission is very much aware of his conviction. *TNX W5YI Report, Vol. 14, Issue #10, May 15, 1992.*

An Indoor or Window-Mounted Vertical Dipole

A floor-to-ceiling antenna for 10-20m.

by Robert H. Johns W3JIP

With a spring-loaded center insulator and rubber tips at the ends, this antenna is held by friction against the floor and ceiling, and is self-supporting. Its parts are less than three feet long and the coils fold up, so it stores nicely. You can also mount it temporarily on a window frame or railing and operate it outdoors.

When set up in a room with an 8-foot ceiling, the antenna is a full half wave on 10 meters, with end capacity hats making up for the lack of vertical length. On lower frequency bands, part of the large split loading coil shown in Photo B is connected into the antenna with an alligator clip. This coil resonates the antenna from 12 to 20m.

Construction Details

Only one loading coil? Yes. This means that the antenna is fed off-center. Even though the coaxial connector is in the middle of the vertical section, the element with the coil in it is electrically longer. The feed point impedance is also higher as a result of the off-center feed. This is convenient, since the impedance of a loaded antenna is often too low for a good match to 50 ohm coax. The two effects nicely balance here, giving this short antenna a low SWR on all bands so that no tuner is needed. Off-center feed is a useful trick for short-loaded antennas.

Since the coils for an indoor antenna are not exposed to the weather like an outdoor antenna, or to the wind load like a mobile whip, it's possible to get much greater Q and efficiency by making the coils big. This is a chance to reclaim some of the losses inherent in indoor operation!

The coils in the photos are approximately 8" in diameter, made from #8 aluminum wire. If you are wondering how in the world you might wind such monsters, have no concern. You can purchase the wire already wound to the proper diameter. Aluminum ground wire (Radio Shack #15-035) comes in 40-foot lengths, and coiled to this diameter. Building the coil requires preparing the PVC insulating ribs and cutting off the proper number of turns of aluminum wire, and then bolting the ribs around the turns of the coils.

This same wire is also used for the capacity hat rods at the ends of the antenna. All of

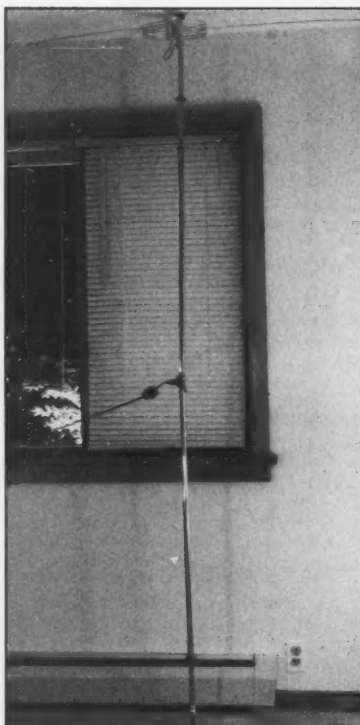


Photo A. The vertical dipole presses against the floor and ceiling to stay in position.

the parts of the antenna are either hardware store or Radio Shack items.

The folding feature comes about because there are only two ribs or supports for the turns, on opposite sides of the coil. They allow the coil wire to twist relative to the plastic ribs when the coil is flattened, as shown in Photo C. However, there is still enough grip on the wire to support the turns in a horizontal position out from the antenna when the coil is opened out again.

The outer end of the aluminum coil is connected to the antenna element via a short length of flexible wire to a ring terminal on its mounting bolt. This short wire connects to the coil by another ring terminal which is bolted to the end of the coil.

The capacity hat rods are three feet long

and are attached to the antenna by inserting them into holes (#30 drill) 1/4" apart, through the end of the aluminum tubing element, as shown in Photo B and Figure 1. The rods are held in place by a 5/16" nut that slides over the two rods and then is threaded onto them to tighten them, as shown in Photo B.

Use two lengths of tubing that telescope to make each element adjustable in length. The antenna will fit against ceilings about 7.5 to 12 feet high. The larger center segments are 3/4" in diameter with a 0.048" wall, three feet long. This size of aluminum tubing is available from hardware departments. The thinner end segments are 5/8" in diameter, also three feet long. Some hardware stores carry this size, but not many. An alternate source is aluminum clothesline poles, from hardware or home building supply stores. These are 5/8" in diameter with a thinner tubing wall, about 0.030". The antenna in the photos uses this material.

One end of each 3/4" segment is slotted and tightened around a 5/8" segment by a hose clamp.

A 3.5" length of the 5/8" aluminum tubing at the tip of each element is separated from the rest of the element. This insulates the capacity hats from the elements. The insulator is a 1/2" CPVC (not PVC) pipe coupling, which is a tapered snug fit around the 5/8" tubing. Gently hammer the two tubes into the coupling and secure them with #8 x 1/2"-long sheet metal screws, as shown in Figure 1. A clip lead about 12" long is attached to the inner element tubing by a 6-32 x 1" bolt and nut. This alligator clip is the adjustable connection to the loading coil, or to the C-hat when no coil is in the antenna.

The center insulator is a 5/8" hardwood dowel, 8" long (see Figure 1 and Photo D). The SO-239 coax connector is mounted by means of 1"-long 6-32 steel bolts. Drill out two of the holes in the connector with a 9/64" bit to provide clearance for the bolts, then solder a 4"-long wire to the center terminal of the SO-239. This will pass through a hole in the dowel and connect to one of the elements by a 6-32 bolt securing the 3/4" aluminum tube to the center insulator, as shown in Photo D.

The heavy spring (C-263, Century Spring

...The Perfect Solution

If you're living in an area with antenna restrictions, if you're tired of hassling with huge multi element yagis or if you're just looking for a compact, rugged, easy-to-use portable antenna that really *works*, the 150 watt IsoLoop 10-30 (MHz) HF Antenna is the Perfect Solution to your antenna problems.

The IsoLoop 10-30 has been redesigned to provide greater durability, lower SWR and extended frequency coverage. Because the loop is isolated from the feedline, your radiated power goes into the antenna, not into the shack. Efficiency is maximized because the new design has no mechanical joints and no assembly is required.

No ground plane or antenna tuner needed!

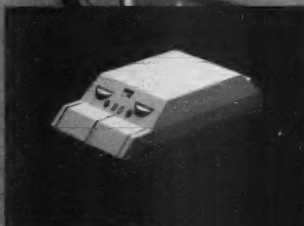
The IsoLoop comes fully assembled complete with LC-2 Loop Controller (including signal strength LEDs) and 50 feet of control cable in a UPS shippable package.

This HF antenna goes where few others have gone before!

See the IsoLoop 10-30 today at your favorite AEA dealer.

For a complete specification sheet on this or any other AEA product, call the toll-free AEA Lit-Line at 1-800-432-8873.

LC-2
Loop Controller.



Advanced Electronic Applications, Inc.

P.O. Box C2160/2006 196th St. S.W. Lynnwood, WA 98036-0918

Technical Support (206) 775-7373 Office (206) 774-5554

BBS (206) 234-5678 CompuServe user ID 76702,1013

All specifications subject to change without notice or obligation.

© AEA, Inc. 1991. All Rights Reserved.



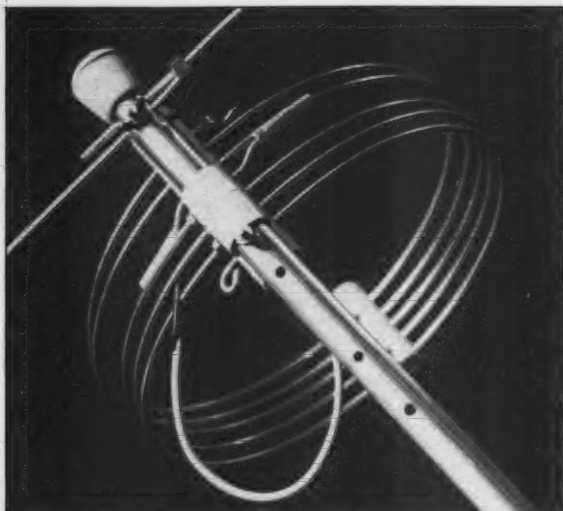


Photo B. The 8" diameter split loading coil has spaced turns so that a clip lead can tap into any point in the coil. The capacity hat rods are each 3 feet long. They are held in place by the large nut around them located near the tip of the element.

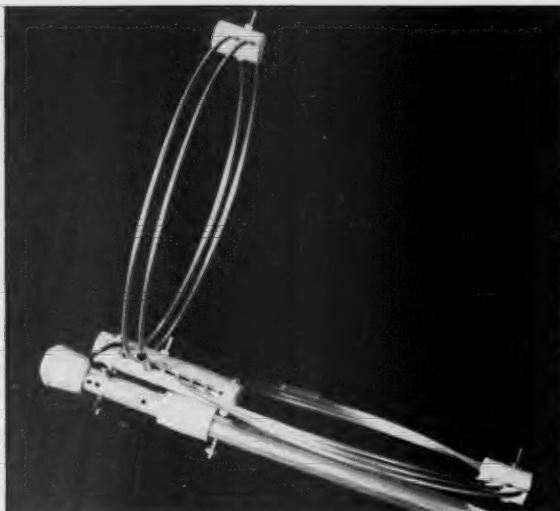


Photo C. Only two turns of the loading coil are connected into the antenna. Three turns are disconnected by sliding away the sleeves that are visible in Figure 2, and the three turns are folded down beside the element. Both coils fold for easy storage.

Corp., in a hardware store spring assortment) is a loose fit around the 5/8" dowel. This spring needs to be stretched so that the turns are spaced apart, as shown in Figure 1-b, and cut with a file or grinding wheel. It is threaded around one of the bolts that supports the coax connector so that it stays in place on the center insulator. With this compression spring in place, electrical contact to the second element of the antenna is made when the tubing is pressed against the spring.

All of the coil supports are made from 1/2" PVC Schedule 40 pipe. The turns of the aluminum coil are held in place by slots in the ribs made by drilling holes (9/64") on 3/8" centers into the pipe, and then sawing the pipe lengthwise through these holes. When the two halves of the pipe are bolted together again, with one turn of the coil in each slot, the coil turns are spaced properly and gripped by the rib. Figure 1 shows side views of coil ribs and the 6-32 x 2" bolts used to mount the coils to the antenna. You also need to drill 9/64" holes for these bolts in both the ribs and the aluminum tubing they mount to.

The 5-turn coil for 12-20m is made in two separate pieces that can be spliced together. The 2-turn coil is used for 12 and 15 meters with the 3-turn coil disconnected and folded down, as shown in Photo C. For 17 and 20 meters, the 3-turn coil is pulled up beside the 2-turn coil and they are spliced together by aluminum sleeves made from 1/4" o.d., 7/32" i.d. tubing, available from hobby stores. These two splices are visible in Photo B, which also shows the ends of the coils bent to bring them next to the adjacent coil.

To assemble a coil, bolt two rib halves together loosely at one end. Slide the aluminum sleeves onto the coils, and then put the aluminum wire between the half-ribs, with one turn in each slot. Hand-tighten the

nut to keep the coil turns in the slots and add the remaining bolts to clamp the rib together. Use wing nuts to attach the coils to the elements. Connect the free eyelet of the solder lug at the top (as shown in Figure 1-a) to the outside end of the 2-turn aluminum coil. Bend the #8 wire into a tight loop that will allow a 6-32 x 1/2"-long brass screw to pass through. A #6 brass or stainless steel finishing washer will take a good bite into the aluminum wire and also wrap around it. Bolt the eyelet, the end of the aluminum wire, and the finishing washer together.

Operation

To set the antenna up between floor and ceiling, the length of the vertical section is adjusted with the hose clamps on the tele-

scoping sections. The antenna is made about 1/2" to 3/4" too long, so that it tilts when held against the floor and ceiling. Then push down on the top section to compress the spring and bring it to a vertical position. The



Photo D. The spring-loaded center insulator. Use a current balun (RF choke) at each end of the coaxial cable. The one shown has 5 turns of RG-58 coax wound on ferrite cores (Radio Shack 273-104).

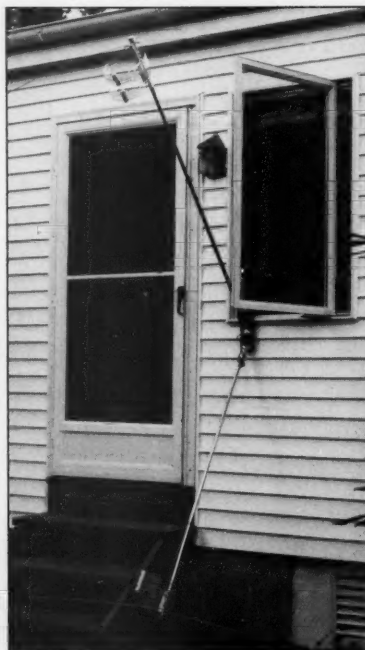


Photo E. The indoor vertical dipole can be window-mounted for better performance. A first-floor window was used for the photo, but the antenna should be as high and clear as possible. Extra coils with 5 turns (top) and 10 turns (bottom) may be added to the antenna, as shown here, for operation on 30 and 40 meters.

NO PROBLEM

You want a bargraph & a full range counter – Optoelectronics can deliver!

\$199.

*Don't Wait,
This Offer Can't Last!
No discounts. No trade-ins.*

Now for a limited time only, \$160.
off the list price. for our Full Range
Model 2810 with bargraph – plus:

- Full range -10Hz to 3GHz.
- LCD display (daylight visibility).
- True state-of-the-art technology with the high speed ASIC.
- NiCads & Charger included.
- Ultra-high sensitivity.
- 4 fast gate times.
- Extruded metal case.
- Compatible with MFJ207.

Suggested options

TA100S:

Telescoping Whip Antenna.....\$ 12.

CC30

Vinyl Carry Case.....\$ 15.

BL28:

EL Backlight for use in roomlight and low light.....\$ 45.

TCXO 30:

Precision ± 0.2 ppm 20 to 40°C temp. compensated time base\$100.

Universal

Handi-Counter™

Model 3000, \$375. and
Bench Model 8030, \$579.
Both offer frequency,
period, ratio and time
interval.



**Made in
the USA**

OPTOELECTRONICS

Call for free catalog - Factory Direct Order Line:

1-800-327-5912

FL (305)771-2050 • FAX (305)771-2052

5821 NE 14th Ave. • Ft. Lauderdale, FL 33334
5% Ship/Handling (Max. \$10) U.S. & Canada.
15% outside continental U.S.A.
Visa and Master Card accepted.

CIRCLE 172 ON READER SERVICE CARD



Photo F. The mounting hardware consists of 3/4" flagpole brackets on a board, and an 18" C-clamp that attaches to the board with a large hose clamp.

5/8" rubber furniture tips (not plastic) will hold it securely and not mark the floor or ceiling. Frequency changes are easier to make if the end with the coil is placed near the floor.

Table 1 gives the approximate number of turns to use for each band. These will vary, depending on how much metal in the building is close to the antenna, and on the height of the ceiling. The small increase in the number of turns from 15 to 17m is because the 3-turn coil must be connected and placed next to the 2-turn coil. This adds inductance from the mutual coupling.

When trying out the antenna for the first time or setting up in a new location, check the SWR across a band. This will tell you if an adjustment is needed. If the SWR is lowest at the low edge of a band, the antenna is too low in frequency. Remove some coil from the antenna by moving the tap (clip lead). If the SWR is best at the high end, add more coil. You are aiming to have minimum

SWR where you operate in a band.

On 10 meters where no coil is used, the clip lead must connect the element to the outer tip in order to have the C-hats in the antenna. If the 10 meter frequency is too low, raise it by pushing in the C-hat rods so that they overlap and don't extend out as far.

An important part of this antenna system is a good RF

choke, or current balun, to isolate the antenna from feedline currents. Especially with off-center feed, the coax will become part of the antenna if you connect it directly to the antenna without a choke. This will be seen as SWR and resonant frequencies that change with cable location, RF feedback (shocks from the radio knobs and squeals from its speaker), and inconsistent results. Use a ferrite-bead coax-shield choke (as reviewed by John Belrose in "Transforming the Balun," *QST*, June 1991, pp. 30-33) or an RF choke formed by winding the coax on ferrite cores as in Photo D.

Outdoor Operation

There are many options for portable operation of this antenna. If you bolt the removable element to the center insulator so that it contacts the spring, you can use the antenna as a horizontal dipole or hang it from a tree as a vertical dipole. You can also put the dipole outside for better ef-



Photo G. A closer view of the window mount in operation. Notice that the indoor dipole's coax connector and center insulator are used here also. The compression spring fits into the mounting bracket and is the electrical connector to one element of the dipole.

ficiency, mounted on a windowsill or railing, as shown in photos E and G.

The two elements, held in a 3/4" flagpole bracket switch, are mounted on a base and clamped to a window or railing with a large carpenter's clamp (see Photos F and G). These are all hardware items. The base can be wood (1" x 3" x 12") or a rigid plastic such as PVC or Plexiglas (1/2" x 3" x 12"). With your flagpole brackets as guides, drill the mounting holes shown in Figure 2, and countersink them so that flathead mounting bolts (3/16" x 1") won't scratch the window frame. The 1/4"-wide, 1"-long slot in the mounting base is for the spine of the long clamp. When the spine is in the slot and a large hose clamp is tightened around the clamp head and the board, they are held securely together.

There are four 3/16" holes for each bracket, even though a bracket mounts with only three. The extra one lets you mount the bracket at right angles to the way they are shown in the photos. This can be used for a horizontal mounting of the elements (first floor apartment) or to clamp the mounting base to the side of the window frame. The antenna can also be clamped to a post or a small tree, as well as a railing. The carpenter clamp and flagpole brackets make a very versatile

Continued on page 64

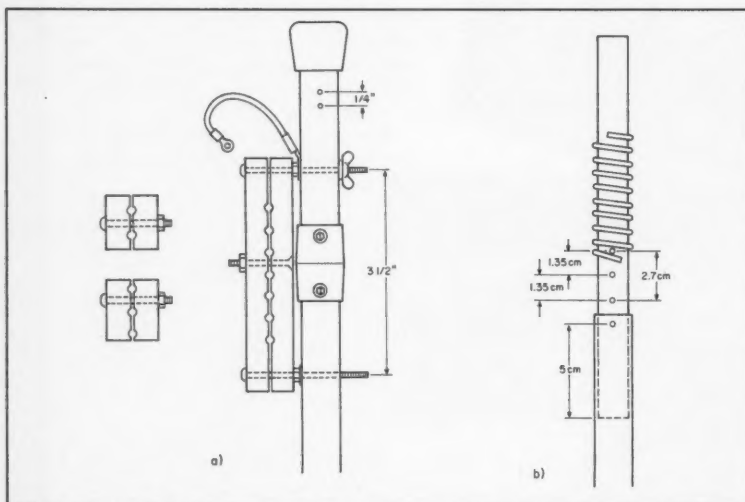


Figure 1. Sketch a) shows the ribs of the coil for 12 through 20 meters, mounted on the antenna. The slots that grip the turns of the coil are made by drilling 9/64" holes in the plastic pipe and then sawing the pipe in two, through the holes. All the bolts are 6-32, preferably brass. The longer ones are 2" and the shorter ones 1". The holes for the bolts are also 9/64". Sketch b) shows the holes to be drilled in the center insulator. These are for mounting the SO-239 connector and for bolting one element to the center insulator.

MFJ 20 Meter CW Transceiver

... throw this *tiny* CW rig in a corner of your briefcase and enjoy DXing and ragchewing wherever you go ... you get a high performance superhet receiver, crystal filter, RIT, AGC, vernier tuning, sidetone, speaker, up to 5 watts output, semi-break-in, more ...

MFJ-9020

\$179⁹⁵

- 15 Meter and other bands available soon
- Free MFJ-9020 manual
- Unconditional Guarantee for one full year

Throw this tiny CW rig in a corner of your briefcase and enjoy DXing and ragchewing wherever you go.

You'll turn lonely nights into exciting adventures as you contact fellow amateurs around the world.

20 Meters is open day and night so you can operate whenever you have a free moment.

With 5 watts you'll have plenty of power to work the world even with a makeshift antenna.

At home with a good dipole, vertical or beam, you'll be able to work almost anyone you hear — can you imagine earning DXCC with 5 watts?

Big gun DX'ers: Try a new DX challenge for the price of a simple station accessory.

It's good enough to be your only rig — you get a high performance superhet receiver, razor sharp 8-pole crystal filter, RIT, AGC, vernier tuning, sinewave sidetone, built-in speaker, headphone jack, adjustable semi-break-in, up to 5 watts output plus much more.

Covers lower 20 Meter CW band, 14.000 to 14.075 MHz. 6x6½x2½ inches. Weighs 1-3/4 lb. Uses 12-15 VDC. Optional plug-in Curtis chip keyer, narrow audio filter, antenna tuner, power pack and antenna.

High Performance Superhet Receiver

You get a high performance superhet receiver with a selective double tuned front end and double-balance mixer. It's sensitive enough to copy weak DX signals down to the noise floor yet resist overload when a strong local comes on.

What you hear is what you get — images and birdies are eliminated with this simple conversion design and a high 10 MHz IF.

A ball bearing reduction drive and linear frequency readout gives you smooth precise tuning.

Half watt of audio gives you plenty of volume from headphones and built-in speaker.

Razor Sharp Selectivity

You'll slice through QRM and pull weak ones out of the mud with an 8-pole crystal filter that gives you razor sharp selectivity with steep sided skirts.

Instant Recovery AGC Circuit™

Weak DX signals are just as loud as strong local ones because the MFJ-9020 graceful Automatic Gain Control (AGC) keeps your

audio level constant.

You get smooth break-in operation because MFJ's exclusive *Instant Recovery AGC Circuit™* gives you instantaneous transmit recovery.

True Receiver Incremental Tuning (RIT)

True Receiver Incremental Tuning (RIT) lets you dodge QRM and compensate for other's drift without moving your transmit frequency.

MFJ Integrated CW Station

Transceiver, tuner, power pack fastens together to form tiny 6x6½x8½ inch integrated CW station.

SAVE \$40

MFJ-9120B

\$329⁹⁰

Save \$40! \$329⁹⁰

buys complete MFJ CW Station. Includes MFJ-9020 transceiver, MFJ-971 tuner, MFJ-4114 power pack, MFJ-1760 antenna ... order MFJ-9120B. \$369.80 if purchased separately (keyer and filter not included.)



Enough Power to Work the World

With 5 watts you'll have plenty of power to work the world even with a makeshift antenna.

You can use any antenna with an SWR up to 3:1. The MFJ-9020 is rugged enough to withstand momentary antenna opens or shorts without damage.

If you're really into QRP you can reduce your power down to milliwatts.

A pleasing sinewave sidetone lets you monitor your sending.

You also get quiet adjustable semi-break-in and adjustable automatic transmit offset.

You'll get hours of battery operation — draws only 50 ma. receive, 1 amp transmit.

Looks Great!

The MFJ-9020 is housed in an attractive matte-black aluminum enclosure with a deluxe brushed-aluminum front panel and matched

knob set. Machine screws and pressed-in PEM nuts are used — not sheet metal screws.

Has power-on LED, transmit LED and SO-239 coax connector for antenna.

Designed by Rick Littlefield, K1BQT

The MFJ-9020 was designed by Rick Littlefield, K1BQT. He's known worldwide for his

reliable high-performance transceiver designs and countless articles.

K1BQT has given careful attention to board layout, heatsinking, mechanical rigidity, voltage regulation and component selection to ensure stable operation and long-term reliability.

It meets or exceeds all FCC requirements.

Comes fully assembled, tested and guaranteed to work

Your factory built MFJ-9020 is ready to work DX right out of the box. It's not a kit of parts you have to put together and hope you can get to work.

Free MFJ-9020 Manual

Manual includes operating instructions, setting up your station, DX techniques, antenna suggestions, trouble shooting guide, theory of operation, alignment procedures, parts placement, schematic, parts list and more.

For free MFJ-9020 manual write or call MFJ.

Plug-in Keyer and Narrow Filter (Optional)

MFJ-412 Curtis chip iambic keyer, \$39.95. MFJ-726 narrow audio filter, \$29.95. Has In/Out switch.

Each plugs into MFJ-9020. Controls on rear panel. No soldering or modifications needed.

No Matter What™ Guarantee

You get MFJ's famous one year *No Matter What™* unconditional guarantee. That means we will repair or replace your MFJ-9020 (at our option) no matter what for a full year.

Continuing Service

MFJ Customer Service Technicians will help you keep your MFJ-9020 performing flawlessly — no matter how long you own it. Just call our toll-free help line 800-647-TECH(8324) — an MFJ exclusive.

Made in USA

The MFJ-9020 is made in the USA. Help our fellow Americans by keeping our money here — buy Made in USA.

Call Your Favorite Dealer Today

Enjoy DXing and ragchewing wherever you go. Call your favorite dealer today and get your MFJ-9020. Don't leave home without it!

Other Bands Available Soon

MFJ CW Transceivers for 15 Meters and other bands available soon. Watch for them.

MFJ Portable Antenna Tuner



MFJ-971 Has Cross-Needle SWR/Wattmeter, covers 1.8-30 MHz, balun for balanced lines, 200 watts PEP. Tunes coax, balanced lines, random wire. Wattmeter has two switchable ranges: 30, 300 or user selectable 6 watt ranges. Tiny 6x6½x2½ inches matches MFJ-9020. Fastens to MFJ-9020 and/or MFJ-4112 Power Pack to form single unit.

MFJ Portable Power Pack



MFJ-4112 Portable Battery/AC Power Pack for MFJ-9020 or other low power transceiver. Provides 12 VDC from eight D cells (not included) or from 110 VAC. 6x6½x2½ inches matches MFJ-9020. Fastens to MFJ-9020, MFJ-971. **MFJ-4114, \$69.95.** Same as MFJ-4112 but includes charging circuit for Ni-cad D cells (not included). 6x6½x3½ inches.

MFJ Portable Antenna



MFJ-1760 Efficient 20 Meter dipole. **\$29⁹⁵** Lightweight, easy to carry, easy to put up. Perfect for portable operation with MFJ-9020.

Nearest Dealer/Orders: 800-647-1800

Technical Help: 800-647-TECH(8324)

• 1 year unconditional guarantee • 30 day money back guarantee (less s/h) on orders from MFJ • Free catalog

MFJ ENTERPRISES, INC.
Box 494, Miss. State, MS 39762
(601) 323-5869; **TELEX:** 53 4590
FAX: (601) 323-6551; Add \$6/s.h.
MFJ ... making quality affordable

Prices and specifications subject to change © 1992 MFJ Enterprises, Inc.

Six-Band Linear Trap Antenna

Multiband operation without coils or capacitors.

by J. Frank Brumbaugh KB4ZGC

Trap dipoles using L/C traps require careful choice of components and adjustment before use. Traps must be waterproofed, and they add extra weight and wind resistance to the flat-top dipole. Components used to construct the traps are an added expense. They also make the antenna more visible where it might be best not to advertise the existence of an antenna.

The linear trap dipole described here is constructed entirely of wire—no coils or capacitors are needed. Any adjustment needed can be done with a pair of diagonal cutters. From a slight distance it is no more noticeable than a single-wire dipole. Less than 175 feet of wire are required, and it provides an isolated half-wave dipole on 40, 20, 17, 15, 12 and 10 meters.

Theory of Operation

The flat-top is a half-wave 40 meter dipole. At five measured points along each half of this dipole single insulated wires, each a quarter-wave long on 10, 12, 15, 17 and 20 meters, are soldered. After trimming to the desired portion of each band, these insulated wires are bundled along the 40 meter dipole with the free ends towards the central feed point. The assembly is then held together neatly with nylon wire ties.

These quarter-wavelength wires, along with the part of the 40 meter dipole along which they extend, become quarter-wave stubs. Because the end of the stub soldered to the main dipole is shorted, the impedance transfer presents a very high impedance at the open end, thus isolating the remainder of the outer ends of the dipole at the position of the open end of the stub. Thus, a half-wave dipole on each band is provided.

Construction

Figure 1 illustrates the layout of one half of the 40 meter dipole. For clarity, the quarter-wave insulated wires are shown expanded. Dimensions are given calculated for the low frequency edge of each band.

The points on the flat-top, identified as A through E, are where the insulated wire stubs are attached and soldered.

Table 1 gives the length of each of the quarter-wave wires, also identified as A through E. Each is connected to the dipole at the point

identified by the same letter. There are two insulated wires for each lettered point, one for each half of the 40 meter dipole.

Cut and strip one end of a pair of insulated wires—the wire gauge is not important—of length A from Table 1. Solder the stripped end of each wire to the two points marked A.

Continue as just described until you have connected the proper insulated wire pairs to points B through D on each half of the dipole. *Do not attach wires to point E at this time.*

The wires at point E will be attached only after the 40 meter dipole has been adjusted to length, so at this time use tape or string to bundle the insulated wires temporarily to each side of the dipole with the open ends extending towards the central feed point.

Adjustment

Step 1. Feed the antenna with a small amount of RF through an SWR meter at some frequency in the 40 meter band where you usually operate. The SWR will probably not be 1:1.

Step 2. Shorten each end of the 40 meter dipole by the same amount, an inch or two, and recheck the SWR.

Step 3. Continue repeating this step until the SWR is as close to 1:1 as possible.

Step 4. Check SWR across the band to determine the 2:1 SWR bandwidth.

Step 5. Attach insulated wires at point E at each end of the 40 meter dipole, and solder. Bring this wire along the flat-top towards the feed point. Use nylon wire ties to bundle all wires neatly against the flat-top.

Step 6. Feed the antenna as described in Step 1 in the 20 meter band.

Step 7. Remove the RF and shorten the open ends of both point E wires an inch or two, and repeat Step 6, for the lowest SWR.

8. Continue repeating Steps 6 and 7 until the SWR is as close to 1:1 as possible.

9. Check across the 20 meter band to determine the 2:1 SWR bandwidth.

10. Repeat Steps 1, 7, 8 and 9 in the 17 meter band, carefully shortening both wires connected to point D.

11. Repeat Step 10 in the 15 meter band, shortening both wires connected to point C.

12. Repeat Step 10 in the 12 meter band, carefully shortening both wires connected to point B.

13. Repeat Step 10 in the 10 meter band, carefully shortening both wires connected to point A.

This completes construction of the linear trap dipole.

Installation

As long as you remember the truism "higher is better," this antenna can be installed as a flat-top, a sloper or an inverted "V." Although it is somewhat more broadband than a trap antenna using L/C traps, the 2:1 SWR bandwidth may shift somewhat up or down in frequency when the antenna is installed in its permanent position. It is unlikely to require further trimming of the quarter-wave wires.

For the purist, attachment points A through D can be moved slightly closer to the feed point during adjustment to further reduce the SWR, although without this refinement the SWR should be below 1.5:1 over a fairly wide range on each band.

Although this antenna is designed to cover the bands from 40 through 10 meters, it is not possible to include the 30 meter band. Each half of the lowest frequency dipole must be at least one half-wave long at the next highest band, so the 30 meter band can be included only if this antenna is expanded to cover 80 meters.

If there is insufficient space for the full flat-top length, the ends of the dipole can be dropped down vertically or at right angles to the horizontal portion with very little loss of capability. Both ends should be dropped the same amount, of course.

For those hams who have space for a long-wire antenna, this linear trap design can be applied at one end of the long wire. Constructed in this manner, a long-wire antenna will be fed at a low impedance point on each band since it will effectively be fed one quarter-wavelength

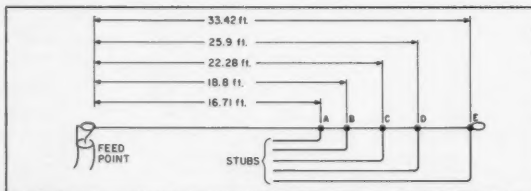


Figure 1. Stub attachment points on one-half a 40 meter dipole.

Table 1. Stub Lengths

Point	Length (feet)
A	8.37
B	9.40
C	11.14
D	12.95
E	16.72

from one end, thus eliminating the need for an antenna tuner.

For those hams using rigs incorporating automatic tuners, an SWR of 1:1 is possible with this antenna on all bands covered, with the possible exception of the very wide 10 meter band.

However, if carefully adjusted as described herein, no antenna tuner should be needed, although one can be used if desired to achieve a broader bandwidth at low SWR. It is also probable that an antenna tuner will match this antenna in the 30 meter band, although this has not been attempted here.

Conclusion

With three insulators, a feedline, less than 175 feet of wire and some minor clipping of wire ends with diagonal cutters, you can have an effective isolated dipole on six of the best DX bands. It does not require an antenna tuner and it is probably the simplest and cheapest multiband antenna which can be constructed by any ham.

Pico-J rolls up and hides in his 4-ounce pocket-sized holder, waiting like the genie in a bottle till you need full-quieting signal punch. Call him forth and his glistening black weather sealed lines reveal a sleek end-fed halfwave antenna ready to hang anywhere. Suspend in the apartment closet or patio doorway. Attach Pico-J to window glass or curtain rod. He needs no radials for broad-band low-angle omni halfwave gain. Carry Pico-J with you for emergencies. Hang in the motel when on the road. He improves range, boosts reception, saves batteries. Pico-J comes ready for work with 72" isolated coaxial feedline and gold pin BNC. Typical edge-to-edge SWR under 1.2:1. Hand-crafted in the U.S.A.

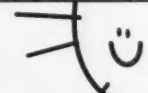
Info \$1
Box 5062-D
Provo, UT
84605

Antennas West
2 meters
220 MHz
440 MHz

Order Hotline
800-926-7373

19.95
ppd

CIRCLE 89 ON READER SERVICE CARD

Help 

"Jerry's Kids"

MDA

Muscular Dystrophy Association
National Headquarters / 3561 East Sunrise Drive
Tucson, AZ 85718 / (602) 529-2000

RF POWER AMPLIFIERS

NEW! 400 WATTS
AVG.
(144-148 MHz)

Model	Pin (W)	Pout (W)	ic (A)	Gain/NF (dB)	(13.8 V) Type
50 MHz					
0503G	1-5	10-50	6	15/0.6	LPA
0508G	1	170	28	15/0.6	Standard
0508R	1	170	28	+	Repeater
0510G	10	170	25	15/0.6	Standard
0510R	10	170	25	+	Repeater
0550G	5-10	375	60	15/0.6	HPA
0550RH	5-10	375	60	+	Repeater HPA
0552G	25-40	375	55	15/0.6	HPA
0552RH	25-40	375	55	+	Repeater HPA

144 MHz					
1403G	1-5	10-50	6	15/0.6	LPA
1406G	25	100	12	15/0.6	Standard
1409G	2	150	25	15/0.6	Standard
1409R	2	150	24	+	Repeater
1410G	10	160	25	15/0.6	Standard
1410R	10	160	24	+	Repeater
1412G	25-45	160	20	15/0.6	Standard
1412R	25-45	160	19	+	Repeater
1450G	5	350	56	15/0.6	HPA
1450RH	5	350	56	+	Repeater HPA
1452G	25	350	50	15/0.6	HPA
1452RH	25	350	50	+	Repeater HPA
1454G	50-100	350	40	15/0.6	HPA
1454RH	50-100	350	40	+	Repeater HPA

220 MHz					
2203G	1-5	10-40	6	14/0.7	LPA
2210G	10	130	20	14/0.7	Standard
2210R	10	130	19	+	Repeater
2212G	30	130	16	14/0.7	Standard
2212R	30	130	15	+	Repeater
2250G	5	220	40	14/0.7	HPA
2250RH	5	250	40	+	Repeater HPA
2252G	25	220	36	14/0.7	HPA
2252RH	25	250	36	+	Repeater HPA
2254G	75	220	32	14/0.7	HPA
2254RH	75	250	32	+	Repeater HPA

440 MHz					
4403G	1-5	7-25	4	12/1.1	LPA
4410G	10	100	19	12/1.1	Standard
4410R	10	100	18	+	Repeater
4412G	20-30	100	19	12/1.1	Standard
4412R	20-30	100	18	+	Repeater
4448G	5	100	22	12/1.1	HPA
4448R	5	100	22	+	Repeater HPA
4450G	5-10	175	34	12/1.1	HPA
4450RE	5-10	175	34	+	Repeater HPA
4452G	25	175	29	12/1.1	HPA
4452RE	25	175	29	+	Repeater HPA
4454G	75	175	25	12/1.1	HPA
4454RE	75	175	25	+	Repeater HPA



All amplifiers (non-rptr) are linear, all-mode with fully automatic T/R switching and PTT capability. The receive preamps use GaAs FET devices rated at 5 dB NF with +18 dBm 3rd order IP. LPA, Standard and HPA amps are intermittent duty design suitable for base and mobile operation. Repeater amps are continuous duty, class C.

Amplifier capabilities: High-power, narrow or wideband; 100-200 MHz, 225-400 MHz, 1-2 GHz, Military (28V), Commercial, etc. - consult factory. A complete line of Rx preamps also available.

RX Preampifiers

Band	Model	NF (dB)	Gain (dB)	Connector
50 MHz	0520B	.5	25	BNC
50 MHz	0520N	.5	25	N
144 MHz	1420B	.5	24	BNC
144 MHz	1420N	.5	24	N
220 MHz	2220B	.5	22	BNC
220 MHz	2220N	.5	22	N
440 MHz	4420B	.5	18	GNC
440 MHz	4420N	.5	18	N
1.2 GHz	1020B	.9	14	BNC
1.2 GHz	1020N	.9	14	N

Consult your local dealer or send directly for further product information. All Products Made in USA.

TE SYSTEMS TEL (310) 478-0501
P.O. Box 25845 FAX (310) 473-4038
Los Angeles, CA 90025

ATV CONVERTERS • HF LINEAR AMPLIFIERS



HF AMPLIFIERS per MOTOROLA BULLETIN

Complete Parts List for HF Amplifiers Described in the MOTOROLA Bulletin.

AN758 300W \$160.70	EB63 140W \$ 89.95
AN757 140W \$ 93.25	EB27A 300W \$130.20
AN778L 20W \$ 83.70	EB104 600W \$448.15
AN778H 20W \$ 93.10	AR305 300W \$383.52
AR313 300W \$460.00	

NEW!! 1K WATT 2-50 MHz Amplifier

POWER SPLITTERS and COMBINERS	
400 Watt PEP 2-Port.....	\$ 69.95
1000 Watt PEP 2-Port.....	\$ 79.95
1200 Watt PEP 4-Port.....	\$ 89.95

100 WATT 420-450 MHz PUSH-PULL LINEAR AMPLIFIER - 55B-FM-ATV

KE867-PK (Kit).....	\$159.95
KE867-PCB (PC Board).....	\$ 19.00
KE867-1 (Manual).....	\$ 9.00

For detailed information and prices, call or write for our free catalog.

UNIVERSAL DIGITAL FREQUENCY READOUT

TK-1 (Wink/Watch).....\$149.95

HEAT SINK MATERIAL

Model 99 Heat Sink (6.5x12x1.5).....\$ 22.99

CNS-6 Copper Spreader (6x12x1/4).....\$ 18.99

We also stock Hard-to-Find parts

CHIP CAPS - Kemet/ATC
METALCLAD MICA CAPS - Unelco/Saneco
RF POWER TRANSISTORS
MINI-CIRCUIT MIXERS.....\$ 6.50
SBL-1 (1-500MHz).....\$ 7.99
ARCO TRIMMER CAPACITORS
VK308-30/48 RF Chokes.....\$ 1.20
50-500-65-10 Ferrite Beads.....\$.20
Broadband HF Transformers.....\$.20

Add \$ 3.50 for shipping and handling.

We ship worldwide.



CCI Communication Concepts Inc.

508 Millstone Drive • Xenia, Ohio 45385 • (513) 426-8600
FAX 513-429-3811



WE SHIP WORLDWIDE

CIRCLE 99 ON READER SERVICE CARD



Packet + AMTOR = PACTOR!!



PACTOR is a new ARQ radioteletype mode developed in Germany. The protocol has been described in CQ-DL and QEX publications.

PacComm's PACTOR controller features:

- Supports PACTOR, AMTOR and RTTY modes
- ON-line data compression
- Automatic speed adaptation
- 15 status LEDs
- Built in Message System
- Error-free data transmission
- Four times faster than AMTOR!
- LED Tuning indicator
- Automatic logbook function accessible over the air

PACTOR was designed to overcome the shortcomings of both packet and AMTOR for HF operation. It combines the small frame size and synchronous handshake mode of AMTOR with the full ASCII character set sup-

port, full callsign support, and better error detection of packet.

The PacComm PACTOR controller is produced under exclusive license from the German developers. List price is \$289.95

The PACTOR unit also supports AMTOR and RTTY operation making it ideal for all modes of HF operation. It will accept a call in either PACTOR or AMTOR and automatically respond in the correct mode. PACTOR commands are similar to packet commands and are easy to learn and use.

Complete amateur callsigns are supported.

NX2P Electronics carries the full PacComm product line including the PACTOR controller. Call or write for more information and our special introductory price. We also carry SoftWrights Terrain Analysis package for VHF propagation studies (see April QST pg 203 or CQ pg 130).

321 East Shore Trail, Sparta, NJ 07871 (201) 729-6927

NX2P Electronics

CIRCLE 161 ON READER SERVICE CARD

COMPLETE Protection Package

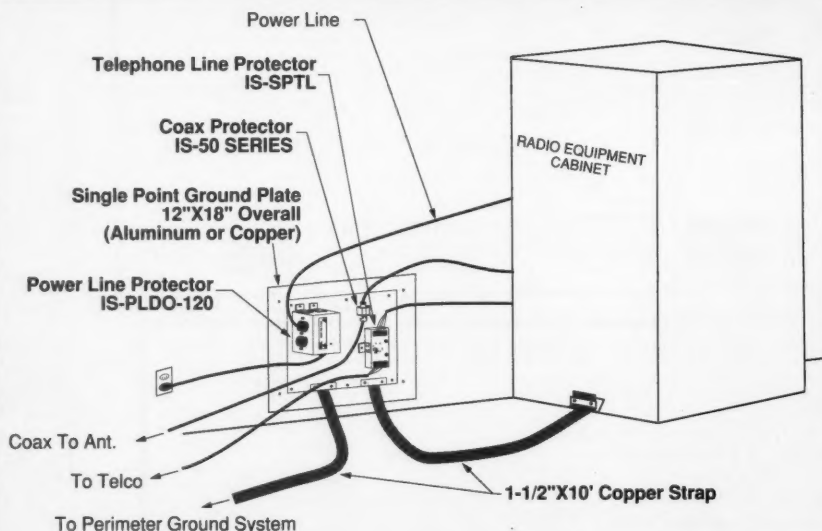
- SINGLE POINT GROUNDING PANEL
- 15A PLUG-IN AC POWER PROTECTOR
- COAX PROTECTOR
- SINGLE TELEPHONE LINE PROTECTOR
- MOUNTING HARDWARE
- FLEXIBLE MOUNTING CONFIGURATIONS
- JOINT COMPOUND

Regular Price \$294⁸⁰

YOURS FOR ONLY...

\$236⁰⁰

**For
information
on this
product,
or any of
our 1500
products
call...**



TYPICAL INSTALLATION

KPolyPhaser[®]
CORPORATION

P.O. Box 9000 • Minden, NV 89423-9000
(702) 782-2511 or (800) 325-7170
Fax (702) 782-4476



BUSINESS REPLY MAIL

FIRST-CLASS MAIL PERMIT NO. 1254 BOULDER CO

POSTAGE WILL BE PAID BY ADDRESSEE

**73 Amateur
Radio Today**

P.O. BOX 50330
BOULDER CO 80321-0330

NO POSTAGE
NECESSARY
IF MAILED
IN THE
UNITED STATES



Place
Stamp
Here

**73 Amateur
Radio Today**

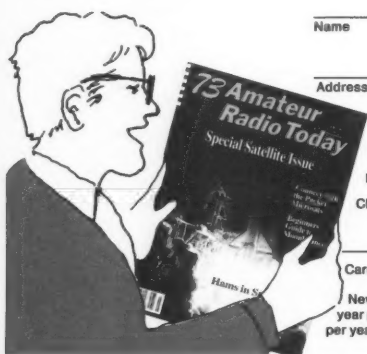
EDITORIAL OFFICE
FOREST ROAD, PO BOX 278
HANCOCK NH 03449-0278



SUBSCRIBE and SAVE

with **73 Amateur
Radio Today**

☐ **YES!** I want to grow with 73. Send me 1 year (12 issues in all) of 73 for the low price of \$19.97 (Save over \$15.00 off the cover price). Mail this postage paid card today or for instant service call toll free 800-289-0388. (In Colorado, call 303-447-9330).



Name _____ (please print) Call _____

Address _____

City _____ State _____ Zip _____

☐ Payment enclosed ☐ Bill me

Charge my: ☐ MC ☐ Visa ☐ Amex

Card Number _____ Exp. Date _____

Newsstand rate \$35.40. Basic subscription rate \$24.97 (Canadian orders add \$7.00 per year plus \$1.40 GST; other foreign countries add \$19.00 per year for surface mail, \$42.00 per year for airmail. Please allow 4-6 weeks for delivery of the first issue.

4APR8

The Pitch: 73 wants to know what you want to read. Help us by voting on this month's features and columns—you'll find their numbers in the Feedback box on the page preceding this card.

The Payoff: Each month we'll draw a card at random. If yours is picked, you'll receive a one-year subscription (or extension) to 73.

FEEDBACK

Article #	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	
Great																										
OK																										
No Way																										

Article #	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	
Great																										
OK																										
No Way																										

I'd like to see more _____ Name _____ (Please Print) Call _____

I'd like to see less _____ Address _____

City _____ State _____ Zip _____

☐ Please enter my one year subscription to 73 for the low price of \$19.97 (Save 43% off the newsstand price). Mail this form or call toll free 1-800-289-0388. (In Colorado, call 303-447-9330)

☐ Payment enclosed ☐ Bill me Charge my: ☐ MC ☐ VISA ☐ AMEX

Card Number _____ Exp. Date _____

Canada add \$7.00 plus \$1.40 GST; Foreign add \$19.00 surface, \$42.00 airmail.

4AP56

FEEDBACK

In our continuing effort to present the best in amateur radio features and columns, we recognize the need to go directly to the source—you, the reader. Articles and columns are assigned feedback numbers, which appear on each article/column and are also listed here. These numbers correspond to those on the feedback card opposite this page. On the card, please check the box which honestly represents your opinion of each article or column.

Do we really read the feedback cards? You bet! The results are tabulated each month, and the editors take a good, hard look at what you do and don't like. To show our appreciation, we draw one feedback card each month and award the lucky winner a free one-year subscription (or extension) to 73.

To save on postage, why not fill out the Product Report card and the Feedback card and put them in an envelope? Toss in a damning or praising letter to the editor while you're at it. You can also enter your QSL in our QSL of the Month contest. All for the low, low price of 29 cents!

- 1 Letters
- 2 Never Say Die
- 3 QRX
- 4 Indoor or Window-Mounted Dipole
- 5 Six-Band Linear Trap Antenna
- 6 10 Meter DSB Transmitter
- 7 Calibrated Signal Generator
- 8 Receive Converter Adapter for 2 Meter Transceivers
- 9 Review: MFJ-9020
- 10 Eight Channel A-to-D Converter
- 11 Review: The Yaesu FT-415
- 12 Protected AC Outlet
- 13 Ham Help
- 14 Hamsats
- 15 Homing In
- 16 ATV
- 17 Circuits
- 18 Above and Beyond
- 19 Special Events
- 20 Ask Kaboom
- 21 New Products
- 22 QRP
- 23 RTTY Loop
- 24 Hams with Class
- 25 73 International
- 26 Barter 'n' Buy
- 27 Dealer Directory
- 28 Random Output
- 29 Propagation
- 30 Updates

Enjoy NEVER CLIMBING YOUR TOWER AGAIN

Are you too scared or too old to climb? Never climb again with this tower and elevator tram system. Voyager towers are 13 and 18 inch triangular structures stackable to any height in 7 1/2", 8 3/4" or 10" section lengths. Easy to install hinge base, walk up erection. Next plumb tower with leveling bolts in base. Mount rotor and large heavy beams on Hazer tram and with one hand winch to top of tower for normal operating position. Safety lock system operates while raising or lowering. At last a cheap, convenient and safe way to install and maintain your beam. This is a deluxe tower system that you can enjoy today.

SPECIAL TOWER PACKAGE: 50 ft. high by 18" face tower kit, concrete footing section, hinged base, HAZER kit, Phillystran guy wires, turnbuckles, earth screw anchors, 10' mast, thrust bearing, tool kit, ground rod and clamp, rated at 15 sq. ft. antenna load @ 100 MPH, \$1974.95.

HAZER KITS

HAZER 2 for Rohm 25-hvy duty alum 12 sq ft wind load	\$24.95
HAZER 3 for Rohm 25-std alum 8 sq ft wind load	\$32.95
HAZER 4 for Rohm 25-hvy galv stl 16 sq ft wind load	\$63.95
TB-25 Ball thrust bearing 2 1/2" max mast dia	74.95

Satisfaction guaranteed. Call today and order by Visa, M/C or mail check. Immediate delivery.

Glen Martin Engineering, Inc.

Dept. A
RR 3, Box 322,
Boonville, MO 65233
816-882-2734
FAX: 816-882-7200



CIRCLE 72 ON READER SERVICE CARD

38,904

ELECTRONIC COMPONENTS

Whether you order 1 part or all 38,904...MOUSER stocks and...can ship today!!

CALL...
(800) 992-9943

for your
FREE
CATALOG

2401 Hwy 247 N
Mansfield, TX 76063

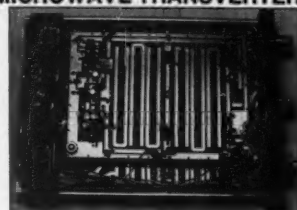


MOUSER ELECTRONICS

Sales & Stocking Locations Nationwide

CIRCLE 64 ON READER SERVICE CARD

MICROWAVE TRANSVERTERS



SHF 1240 Complete Transverter

SHF SYSTEMS No tune linear transverters and transverter kits for 902, 1269, 1296, 2304, 2400, 3456 MHz. All use 2m i.f. 13.8V. Kits include mixer and L.O. P.C. boards, xtal and all components. Built units include I.F./D.C. switchboard, connectors and compact low profile housing. Other frequency options in amateur band available.

SHF 900K	902-906 MHz	50mW	KIS139	Built \$265
SHF 1240K	1296-1300 MHz	10mW	KIS149	Built \$265
SHF 1269K	1268-1272 Oscar Mode	L10mW	KIS140	Built \$255
SHF 2304K	2304-2308 MHz	10mW	KIS205	Built \$325
SHF 2401K	2400 MHz Mode S rev Conv		KIS155	Built \$255
SHF 3456K	3456-3460 MHz	10mW	KIS205	Built \$325
SHF 5760K	5760 MHz/1296 IF	0.5mW	KIS170	Built \$260
NEVER ORDER	432K 420-450 MHz 10m IF	70mW	KIS150	Built \$275

DOWN EAST MICROWAVE

Bill Olson, W3HQT
Box 2310, RR1 Troy, ME 04987
(207) 948-3741 FAX: (207) 948-5157

MICROWAVE AMPLIFIERS from

DOWN EAST MICROWAVE

Linear Power Amps			
for SSB, ATV, FM, 902—1296—2304—3456MHz			
2303 PA	10mW in 3W out	1240-1300 MHz	\$130
2318 PAM	0.5W in 18W out	1240-1300 MHz	\$205
2335 PA	10W in 35W out	1240-1300 MHz	\$325
2340 PA	1W in 35W out	1240-1300 MHz	\$355
2370 PA	5W in 70W out	1240-1300 MHz	\$695
3318 PA	1W in 20W out	902-928 MHz	\$275
3335 PA	14W in 40W out	902-928 MHz	\$335
3310 PA	10mW in 10W out	902-928 MHz	\$150
432 PA	70mW in 16W out	420-450 MHz	\$180

T/R Switching available, all 13.8 VDC. Some available in kit form. Low Noise Preamps & preamp kits—432, 902, 1296, 1691, 2304, 2401, 3456 MHz, 5.7 and 10 GHz.

331NA	preamp 5 dB NF	902 MHz	13.8V \$ 95
231NA	preamp 5 dB NF	1296 MHz	13.8V \$ 95
131NA	preamp 7 dB NF	2300-2400 MHz	13.8V \$130
1691LNAWP	preamp 1 dB NF	1691 MHz mast mounted	13.8V \$140
4017LNAK	preamp kit	400-1700 MHz	8.0V \$ 40
Preamp kits for 2304-10 GHz Write or Call			

CALL OR WRITE FOR MORE INFORMATION

DOWN EAST MICROWAVE

Bill Olson, W3HQT
Box 2310, RR1 Troy, ME 04987
(207) 948-3741 FAX: (207) 948-5157

MICROWAVE ANTENNAS



Loop Yagis, Power Dividers, Stacking Frames, Complete Array of 902, 910, 1269, 1296, 1691, 2304, 2401, 3456 MHz. For Tropo, EME, Weak Signal, OSCAR, ATV, Repeaters, WEFAX, Commercial point to point. Available in kit form or assembled and tested.

3333LYK	33el loop Yagi Kit	902 MHz	18.5 dBi	\$ 95.00
2345LYK	45el loop Yagi Kit	1296 MHz	21 dBi	\$ 95.00
2445LYK	45el loop Yagi Kit	1269 MHz	21 dBi	\$ 95.00
1844LY	44el loop Yagi (assem.)	1691 MHz	21 dBi	\$105.00
2355LYK	55el Superlooper Kit	1296 MHz	22 dBi	\$108.00
1345LYK	45el loop Yagi Kit	2304 MHz	21 dBi	\$ 79.00
945LYK	45el loop Yagi Kit	3456 MHz	21 dBi	\$ 79.00

Other models available. Call or write for catalog.

DOWN EAST MICROWAVE

Bill Olson, W3HQT
Box 2310, RR1 Troy, ME 04987
(207) 948-3741
FAX: (207) 948-5157

10 Meter DSB Transmitter

Easy to build and no tuning required.

by Carl Lyster WA4ADG

Here is an ideal construction project: a no-tune, 1-watt output, CW/double-sideband transmitter which is a breeze to build, and low cost to boot! The heart of this unit is a small precision oscillator that is used as a 28.322 MHz clock on computer video cards, and is available at a cost of only a few dollars. How convenient!

Bill Brown WB8ELK alerted me to the availability of this jewel and asked if I could come up with a simple DSB transmitter. Never being one to turn down an interesting challenge, I decided to design a simple but versatile unit that could be used in DSB as well as CW modes. In order to keep cost to a minimum, I chose to use readily available parts and incorporate some of the latest technology components in the design, along with a whopping \$1.50 final transistor! The total cost, including commercially made PC board, is about \$25.

I hope a large number of experimenters take this project to heart and that the frequency of 28.322 MHz becomes a new breeding ground for tinkering-minded hams. [Ed. Note: Other frequencies can be custom ordered - see the Parts List for details.]

Why Double-Sideband Suppressed Carrier?

This question is all a matter of dollars and sense. The traditional SSB transmitter requires some form of expensive filter to remove the undesired modulation sideband and pass the desired one on to the remaining electronics. Of course there are ways to produce an SSB signal that does not require a crystal filter. I have seen articles on "rolling your own" filters from cheap surplus crystals, but all of these methods are well beyond the capability of the beginner. The old adage "Keep it simple stupid" certainly applies here; we don't want people getting "Pink Tickets" from the FCC because their home-brew transmitters are contaminating the air waves.

It is true that double-sideband modulation consumes extra spectrum space. I would not even consider building a DSB transmitter for any frequency below the 10m band. DSB modulation has several advantages that make it the ideal choice for this project. First, a DSB signal can be received by all who own DSB or SSB receivers. I have read that a direct conversion receiver will not receive DSB signals, but this is a minor concern. Second, a DSB suppressed carrier sig-

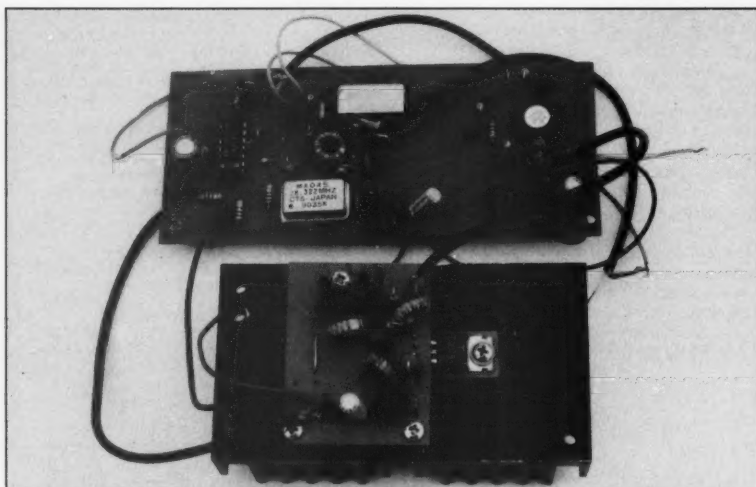


Photo. The 10 meter DSB transmitter. The main transmitter is capable of 100 milliwatts. The small amplifier board will provide you with a 1-watt output.

nal is more efficient than simple AM modulation. Third, and most important, a DSB signal is very easy to generate! [Ed.note: Please note that you need at least a General class license to operate DSB.]

DSB Suppressed Carrier Modulation

To understand DSB suppressed carrier modulation, a quick review of its close cousin, AM modulation, will help. In AM, a carrier is modulated by varying the amplitude of the RF signal at an audio rate; this can be accomplished by the use of a modulation transformer or by modulating the DC power applied to a low level amplifier stage in the transmit chain. The resultant signal is a mixture of the original RF frequency plus (the sum of the RF frequency and the audio frequency) and (the subtraction of the RF frequency and the audio frequency). These sums and differences are referred to as the upper and lower sidebands, respectively. They contain all of the intelligence associated with the AM signal; the presence of the carrier is simply wasted energy. It would be much more efficient to eliminate the carrier and devote the entire transmitter power to the sidebands. This is precisely what is achieved with DSB suppressed carrier modulation. Due to the fact that both sidebands are mirror images of each other, they contain the same information. For even greater effi-

ciency, we could eliminate one of the sidebands by the use of an expensive crystal filter, and transmit a single sideband signal. However, for our simple transmitter we shall be content with a low-cost DSB signal.

Circuit Operation

It would be easy to breeze through this section with only a cursory description of the circuit functions, however I would feel like I was cheating you if you did not fully understand the operation of what you were building. Part of the appeal of ham radio is learning the innermost secrets of the equipment that you are operating, so I shall endeavor to explain the purpose of each and every component in this device! See Figure 1 for the schematic.

The Oscillator Section

The oscillator module produces a 4-volt peak-to-peak square wave at 28.322 MHz, which is the carrier frequency. The output of the oscillator is capacitively coupled to transformer T1 by capacitor C1. Only a small portion of the 4-volt signal is needed, so resistor R1 reduces the level applied to T1. T1 serves an unusual function in this circuit. It is used to convert the square-wave output of the oscillator into a sine wave. This is accomplished by the resonant action of T1's primary and capacitor C3. The sharp

WE SHIP WORLDWIDE

Barry Electronics Corp.

WORLD WIDE AMATEUR RADIO SINCE 1950
Your one source for all Radio Equipment!



Lewis W2BIE, Kitty WA2BAP, Jan KB2RV
Join us for the latest
in amateur/ commercial radio
AND SHORTWAVE RADIOS.

KENWOOD



ANTENNAS
A-S, AES, Cushcraft, Hy-Gain,
Hustler, KLM, METZ, Urban,
MODUBLOX, TONNA, Buttermut,
Multi-Band

TS450S/AT, R-5000, TS-850S, TM 241/A,
441A, TR-751A, Kenwood Service Repair,
TS140S, TS690S, RZ-1, TS-790A, TS950SD,
TH-78A, TH28/48A, TM-941A, TM-741A,
TM-732A, TM-641A

AMPLIFIERS STOCKED:
RF Concepts
Mirage
TE Systems

MARINE RADIOS
ICOM M7, M11, M56, M700TY, M800
AVIATION PORTABLE ICOM A-21
KING KC-99

Budwig ANT. Products
FLUKE 77, 83, 85, 87 Multimeters

GEOCHRON

World Time Indicators

VoCom/Mirage/Airco
VoCom/Mirage/TE SYSTEMS
Amplifiers & 5/8λ HT Gain
Antennas IN STOCK

G&G ELECTRONICS ART1,
Air Disk, SWL, Morse Coach

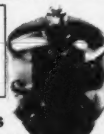
Panasonic

Shortwave Radios/Marine

Telephone scramblers
for cellular and
phones. \$299.00 each

Phillips DC-777
FM, MW, LW, SW
Cassette Car Stereo

Alpha Delta
Products
Stocked



EIMAC
3-500Z
572B, 6JS6C
12BY7A &
6146B

AEA Isopoles
(144, 220, 440
MHz), Iso-loop.

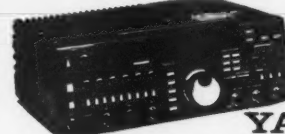
BIRD
Wattmeters &
Elements
In Stock



AOR-AR900, 1000, 2500, 2800,
3000—wide range scanners

Wide selection of SW & Amateur
Publications

Not available for export



YAESU
FT-767GX, FT-890, FT-747GX, FT-990,
FRG-8800, FT-736R, FT-1000D, FT-415/815
FT-5200, FT-2400, FT-470

YAESU ICOM
FT-23R/26/76 IC2/3/4SAT
FT411E-811-911 IC02AT/2SRA
FT-2008/7008 IC2/4GAT/24AT
IC-A21/U16



IC-W2A



IC-H16/U16



MOTOROLA RADIOS
COMMERCIAL RADIOS



TH-78A



FT-470



MOTOROLA

DAIWA

MOTOROLA AUTHORIZED DEALER
KACHINA COMMUNICATIONS DEALER

SONY

DEALER
DIGITAL FREQUENCY COUNTERS
OPTOELECTRONICS model 1300 H/A, 0-1300MHz
2300, 2210 H, 0-2200 MHz, 2600H, UTC-3000, 2810

Long-range Wireless
Telephone for export in stock

BENCHER PADDLES
BALUNS LOW PASS FILTERS
IN STOCK

MIRAGE AMPLIFIERS
ASTRON POWER SUPPLIES
Belden Wire & Cable, Int'l Wire
OPTO KEYERS STOCKED

JRC
NRD-525,
JST135,
NRD-535D

COMET ANTENNAS
STOCKED



HEIL
EQUIPMENT
IN STOCK

DRAKE

Hy-Gain Towers
will be shipped
direct to you
FREE of
shipping cost.

IIX Towers, Antennas,
Mobile Radio mounts
stocked. Call.

AMERITRON AUTHORIZED DEALER

For the best buys in town call:
212-925-7000
Los Precios Mas Bajos en Nueva York
WE SHIP WORLDWIDE!



ICOM

IC-R71A, 751A, 781, 229H, R-7000, IC-765,
IC-726, 3230H, 729 & 728, IC-901, R-7100,
IC-2410A/2500A, R-1, R-72, R-100, P2/P4AT



CES

Simplex Autopatch SDI-50 Will Patch FM
Transceiver To Your Telephone. Great For
Telephone Calls From mobile To Base. Simple
To use. SDI-50



Connect Systems (CSI)
PRIVATE PATCH V, Duplex 8200,
CS800
TUNERS STOCKED:
NYE MBV-A 3 Kilowatt Tuner



MFJ-989C

Covercraft Coaxial Stocked

SHORTWAVE RECEIVERS
STOCKED

**Radios for Business,
Gov't, 2-way, etc.
Stocked & Serviced,
Call for Great Prices!**

MAIL ALL ORDERS TO: BARRY ELECTRONICS CORP., 512 BROADWAY, NEW YORK CITY, NY 10012 (FOUR BLOCKS NORTH OF CANAL ST., BETWEEN SPRING AND BROOME ST.)

New York City's

LARGEST STOCKING HAM DEALER
COMPLETE REPAIR LAB ON PREMISES

"Aqui Se Habla Espanol"

BARRY INTERNATIONAL TELEX 12-7670

Monday-Friday 9 A.M. to 6:00 P.M.
Saturday & Sunday 10 A.M. to 5 P.M. (Free Parking)

IRT/LEX—"Spring St. Station". Subways: BMT-
"Prince St. Station". IND—"F" Train-Bwy Station"
Bus: Broadway #6 to Spring St. Path-9th St./6th Ave.
Station.

COMMERCIAL RADIOS STOCKED: ICOM, Motorola, MAXON, Standard, Yaesu. We serve municipalities, businesses, Civil Defense, etc. Portables, mobiles, bases, repeaters...

ALL
SALES
FINAL

Technical help offered upon purchase

We stock: AEA, ARRL, Ameco, Ameritron, Antenna Specialists, Astatic, Astron, B&K, Belden, Benchner, Bird, Buttermut, CES, Cushcraft, Daiwa, Elmac, Henry, Heil, Hustler, Hy-Gain, Icom, KLM, Kantronics, Larsen, MFJ, Mirage, Nye, Palomar, RF Products, Shure, Tempo, TUBES, Yaesu, Vibroflex, Duplexers, Repeater, Scanners, Radio Publications,

WE NOW STOCK COMMERCIAL COMMUNICATIONS SYSTEMS
HAM DEALER INQUIRES INVITED PHONE IN YOUR ORDER & BE REIMBURSED
COMMERCIAL RADIOS stocked & serviced on premises.
Amateur Radio Courses Given On Our Premises, Call
Export Orders Shipped Immediately. TELEX 12-7670

FAX: 212-925-7001

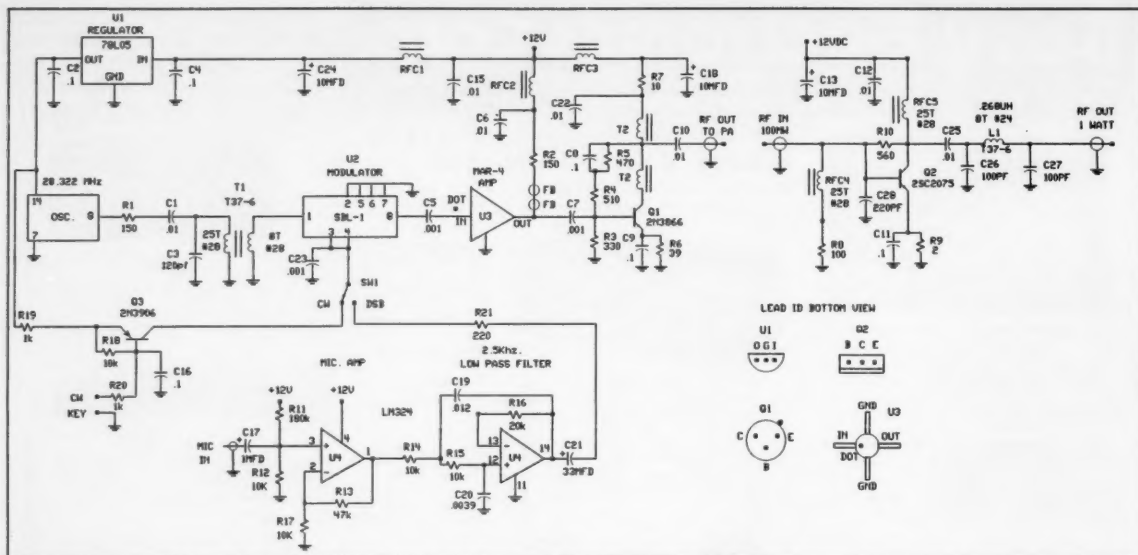


Figure 1. Schematic diagram of the 10 meter DSB exciter board and the optional 1-watt power amplifier.

spikes which occur at each half cycle of the square wave, coupled into T1 by C1, excite the primary and store energy in the toroid core. The resonant properties of T1's primary and capacitor C3 convert the stored energy into a very respectable sine wave which is coupled out of T1 by the 8-turn secondary.

I actually built a transmitter without this square-to-sine-wave converter and it performed very well. However, I was able to detect an increase in carrier suppression with the converter in place. These three parts are a small price to pay for increased performance.

The Mixer Section

Across the secondary of T1 is approximately 0.6 Vp-p, which is applied to the double-balanced mixer module U2. The mixer is one of the "high-tech" devices used in this design. It replaces a handful of transformers and matched diodes with a small package, pretested and guaranteed to meet published minimum specs. From the mouth of experience I can tell you that trying to "roll your own" double-balanced mixer is no fun! These devices are true marvels and have many different uses.

I have exploited two different properties of double-balanced mixers in this circuit: the traditional use as a mixer for the generation of DSB, and as a controlled attenuator for the generation of CW. Switch S1 selects the signal source that is fed into the IF port of the mixer.

The IF port is connected to the diodes which form the active portion of the mixer. In DSB mode, audio is directed into the mixer diodes from the audio amp and filter composed of IC U4. With no audio volt-

age present at the diodes, the mixer does not pass the carrier energy on to the remaining stages. When audio drive is applied to the diodes, they begin to conduct and perform their function as a balanced mixer.

The amplitude of the sideband energy output is proportional to the audio drive input. The carrier is removed by the action of the mixer; only the sidebands are contained in the output.

The term "carrier suppression" is a ratio

of the energy output of the mixer with full audio drive applied, and the output of the mixer with no audio drive applied. Carrier suppression is expressed in dB and can be considered as a "quality factor" in comparing the performance of various types of mixers. This transmitter has attained a measured carrier suppression of 45 dB, which is a very impressive performance for such an inexpensive circuit. I have spent long hours improving this circuit to achieve such a level, one

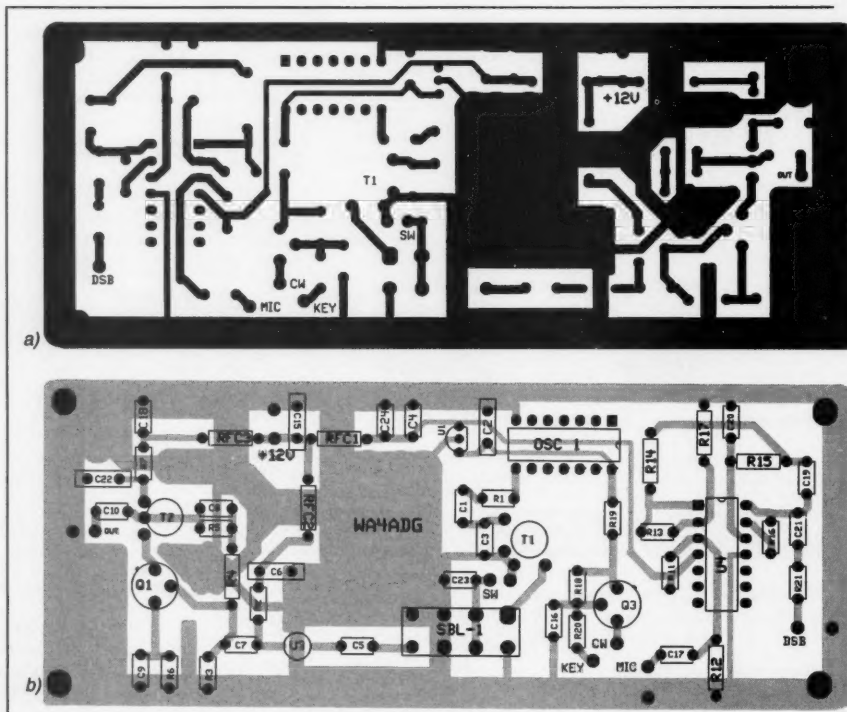


Figure 2. (a). PC board foil pattern for the main DSB exciter. (b). Parts placement.

RAMSEY ELECTRONICS

•2 METERS
•223 MHz
•440 MHz

FANTASTIC FM TRANSCEIVERS SYNTHESIZED—NO CRYSTALS



\$149.95

Ramsey breaks the price barrier on FM rig! The FX is ideal for shack, portable or mobile. The wide frequency coverage and programmable repeater splits makes the FX the perfect rig for Amateur, CAP or MARS applications. Packeters really appreciate the dedicated packet port, "TRUE-FM" signal and almost instant T/R switching. High speed packet? No problem. Twelve diode programmed channels, SW RF output, sensitive dual conversion receiver and proven EASY assembly. Why pay more for a used foreign rig when you can have one AMERICAN MADE (by you) for less. Comes complete less case and speaker mike. Order our matching case and knob set for that pro look.

FX-146 kit (2 Meters) \$149.95
FX-223 kit (1 1/4 Meters) \$149.95
FX-440 kit (3/4 Meters) \$169.95
CFX matching case set \$ 24.95



COM-3
\$2795.00

2 WAY RADIO SERVICE MONITOR

COM-3, the world's most popular low-cost service monitor. For shops big or small, the COM-3 delivers advanced capabilities for a fantastic price—and our new lease program allows you to own a COM-3 for less than \$3.00 a day. Features ▶Direct entry keyboard with programmable memory ▶Audio & transmitter frequency counter ▶LED bar graph frequency/error deviation display ▶0.1-10,000 µV output levels ▶High receive sensitivity, less than 5 µV ▶100 kHz to 999.9995 MHz ▶Continuous frequency coverage ▶Transmit protection, up to 100 watts ▶CTS tone encoder, 1 kHz and external modulation.



RSG-10
\$2495.00

SYNTHESIZED SIGNAL GENERATOR

Finally, a low-cost lab quality signal generator—a true alternative to the \$7,000 generators. The RSG-10 is a hard working, but easy to use generator ideal for the lab as well as for production test. Lease it for less than \$3.00 a day. Features ▶100 kHz to 999 MHz ▶100 Hz resolution to 500 MHz, 200 Hz above ▶-130 to +10 dBm output range ▶0.1 dB output resolution ▶AM and FM modulation ▶20 programmable memories ▶Output selection in volts, dB, dBm with instant conversion between units ▶RF output reverse power protected ▶LED display of all parameters—no analog guesswork!

FREQUENCY COUNTERS

CT-70 7 DIGIT 525 MHz

CT-90 9 DIGIT 600 MHz

CT-125 9 DIGIT 1.2 GHz



Ramsey Electronics has been manufacturing electronic test gear for over 10 years and is recognized for its lab quality products at breakthrough prices. All of our counters carry a full one-year warranty on parts and labor. We take great pride in being the largest manufacturer of low-cost counters in the entire U.S.A. Compare specifications. Our counters are full-featured, from audio to UHF, with FEET high impedance input, proper wave shaping circuitry, and durable high quality epoxy glass plated thru PC board construction. All units are 100% manufactured in the U.S.A. All counters feature 1.0 ppm accuracy.

NEW CT-250 2.5 GHz

ACCESSORIES FOR COUNTERS

Telescopic whip antenna—BNC plug, WA-10 \$11.95
High impedance probe, light loading, HP-1 \$16.95
Low-pass probe, audio use, LP-1 \$16.95
Direct probe, general purpose use, DP-1 \$16.95
Tilt bail, elevates counter for easy viewing, TB-70 \$9.95
Rechargeable internal battery pack, BP-4 \$8.95
CT-90 oven timebase, 0.1 ppm accuracy, OV-1 \$9.95

ALL COUNTERS ARE FULLY WIRED & TESTED

MODEL	FREQ. RANGE	SENSITIVITY	DIGITS	RESOLUTION	PRICE
CT-50	10 Hz-600 MHz	<25 mV to 500 MHz	8	1 Hz, 10 Hz	\$189.95
CT-70	10 Hz-550 MHz	<50 mV to 150 MHz	7	1 Hz, 10 Hz, 100 Hz	\$139.95
CT-90	10 Hz-600 MHz	<10 mV to 150 MHz <150 mV to 600 MHz	9	0.1 Hz, 10 Hz, 100 Hz	\$169.95
CT-125	10 Hz-1.25 GHz	<25mV to 50 MHz <15 mV to 500 MHz <100 mV to 1 GHz	9	0.1 Hz, 1 Hz, 10 Hz	\$189.95
CT-250	10 Hz-2.5 GHz typically 3-0 GHz	<25 mV to 50 MHz <10 mV to 1 GHz <50 mV to 2.5 GHz	9	0.1 Hz, 1 Hz, 10 Hz	\$249.95
PS10B Prescaler	10 MHz-1.5 GHz, divide by 1000	<50 mV	Convert your existing counter to 1.5 GHz		\$89.95



SPEEDY
SPEED RADAR
\$89.95
complete kit
SG-7

New low-cost microwave Doppler radar kit "clocks" planes, boats, horses, bikes or any large moving object. Operates at 2.6 GHz with up to 1/4 mile range. LED digital readout displays speed in miles per hour, kilometers per hour or feet per second. Earphone output allows for listening to actual doppler shift. Uses two 1-b coin cell cans for antenna (not included). Runs on 12 VDC. Easy to build, all microwave circuitry is PC strip-line. ABS plastic case with speed graphics for a professional look. A very useful and full-of-fun kit.

BROADBAND PREAMP

Boost those weak signals to your scanner, TV, shortwave radio or frequency counter. Flat 25 dB gain, 1 to 100 MHz, 3 dB NF. BNC connectors. Runs on 12 VDC or 110 VAC. PR-2, wired, includes AC adapter \$59.95

FM WIRELESS MIKE KITS

Pick the unit that's right for you. All units transmit stable signal in 88-108 MHz FM band up to 300' except for hi power FM-4 that goes up to 1/2 mile.
FM-1, basic unit \$5.95
FM-2, as above but with added mike preamp \$7.95
FM-4, long range, high power with very sensitive audio section, picks up voices 1/2 way \$14.95
MC-1, miniature sensitive mike carrier for FM-1,2,4 \$2.95



FM-3
SHOW N'
TELL

2M POWER AMP

Easy to build power amp has 8 times power gain, 2W out, 2W in, 18W out, SW is for 40W out. Same amp as featured in many ham magazine articles. Complete with all parts, less case and T-R relay.
PA-1, 40W pwr amp kit \$34.95
TR-1, RF sensed T-R relay kit \$11.95

**MICROWAVE
INTRUSION ALARM**
A real microwave Doppler sensor that will detect a human as far as 10 feet away. Operates on 1.3 GHz, and is not affected by heat, light, or vibrations. Drives up to 100 mA output, normally open or closed, runs on 12 VDC. Complete kit MD-3 \$19.95

MUSIC MACHINE
Neat kit that will produce 25 different classical and popular tunes, 3 or 4 different sounds. Lots of fun for doorbells, shop, or store entrances, car horn, music boxes, etc. Runs on 9V battery or wall transformer. Excellent speaker volume and adjustable tempo and pitch. Add our case set for a handsome finished look.
Complete kit, MM-5 \$24.95
Case + knob set, CMM-5 \$12.95

PACKET RADIO
Two new versions are available for the Commodore 64 (P-64A) or the IBM PC (P-IBM). Easy assembly "NO TUNING". Includes FREE disk software, PC Board and Full Documentation.
KIT P-64A \$59.95
KIT P-IBM \$59.95
Case CSPK \$12.95

TONE DECODER
A complete tone decoder on a single PC board. Features: 400-5000 Hz adjustable range via 20-turn pot, voltage regulation, 567 IC. Useful for touch-tone burst detection, FSK, etc. Can also be used as a stable tone encoder. Runs on 5 to 12 volts.
Complete kit, TD-1 \$6.95

VOICE ACTIVATED SWITCH
Voice activated switch provides switched output with current capability up to 100 mA. Can drive lights, lights, LED, or even a tape recorder motor. Runs on 9 VDC.
VS-1 kit \$6.95

TELEPHONE TRANSMITTER
Mini-sized with professional appearance. Self-powered from phone line, transmits in FM broadcast band up to 1/4 mile. Installs easily anywhere on phone line or inside phone!
PB-1 kit \$14.95

TICKLE STICK
A shocking kit! Blinking LED attracts victims to pick up innocent-looking can. You watch the fun! Ideal for office desks, parties, nosy know-it-alls!
TS-1 kit \$9.95

LIGHT BEAM COMMUNICATORS
Transmits audio over infrared beam up to 30'—use simple lens to go up to 1/4 mile! Hum free, uses 30 kHz carrier. Great for wireless earphones or undetectable "bug". Transmitter + receiver set, LB56 \$19.95

FM RADIO
Full-fledged superhet, microvolt sensitivity, IC detector and 10.7 MHz IF. Tunes Sid. FM broadcast bands as well as large portions on each end. Ideal for "bug" receiver, build by experiments or even as FM radio!
FR-1 kit \$19.95

SUPER SLEUTH
A super sensitive amplifier which will pick up a pin drop at 15 feet! Great for monitoring baby's room or as general purpose amplifier. Full 2W rms output. Runs on 6 to 15 volts, uses 6-45 ohm speaker.
BN-1 kit \$6.95

BROADBAND PREAMP
Very popular sensitive all-purpose preamp, ideal for scanner, TV's, VHF/UHF rigs, counters. Low noise, 20 dB gain, 100 kHz-1 GHz, 9V-12VDC operation.
SA-7 kit \$14.95

2 MTR & 220 BOOSTER AMP

Here's a great booster for any 2 meter or 220 MHz hand-held unit. These power boosters deliver over 30 watts of output, allowing you to hit the repeater's full quelling while the low noise preamp remarkably improves reception. Ramsey Electronics has tested thousands of 2 meter amp kits, but now we offer completely wired and tested 2 meter, as well as 220 MHz, units. Both have all the features of the high-priced boosters at a fraction of the cost.
PA-10-2 MTR POWER BOOSTER (10 X power gain)
Fully wired & tested \$89.95
PA-20-220 MTR POWER BOOSTER (8 X power gain)
Fully wired & tested \$89.95



QRP TRANSMITTERS HAM RECEIVERS

20, 30, 40, 80M CW TRANSMITTERS



20, 30, 40, 80M All Mode RECEIVERS

Join the fun on QRP! Thousands of these mini-rigs have been sold and tons of DX contacts have been made. Imagine working Eastern Europe with a \$30 transmitter—that's ham radio at its best! These CW rigs are ideal mates to the receivers at right. They have a variable crystal control (one popular QRP XTAL included), one watt output and built-in antenna switch. Runs on 12VDC. Add our matching case and knob set for a handsome finished look.
Your choice of bands \$29.95
(Specify band: QRP-20, 30, 40 or 80)
Matching case & knob set, CQRP \$12.95

Build your own mini ham station. Sensitive all-mode AM, CW, SSB receivers use direct conversion design with NE602 IC as featured in QST and ARRL handbooks. Very sensitive receiver tuned over entire band. Plenty of speaker volume. Runs on 9V battery. Vroom! EASY to build, lots of fun and educational—ideal for beginner or old pro. New 30-page manual. Add the case set for well-fitted professional look.
Your choice of bands \$29.95
(Specify band: HR-20, HR-30, HR-40, HR-80)
Matching case & knob set, CHR \$12.95

E-Z KEY CMOS KEYS

Send perfect CW within an hour of receiving this kit! Easy-to-build kit has sidetone oscillator, speed control and keys most any transmitter. Runs for months on a 9V battery. 28-page manual gives ideas on making your own key for extra savings. Add our matching case set for complete station look.
CW-7 kit \$24.95
Matching case knob set, CCW \$12.95

ACTIVE ANTENNA

Cramped for space? Get longwire performance with this desktop antenna. Properly designed unit has dual HF and VHF circuitry and built-in whip antenna, as well as external jack. RF gain control and 9V operation makes unit ideal for SWLs, traveling hams or scanner buffs who need hotter reception. The matching case and knob set gives the unit a hundred dollar look!
AA-7 kit \$24.95
Matching case & knob set, CAA \$12.95

2, 6, 10 MTR, 220 FM RECEIVERS



Keep an ear on the local repeater gang, monitor the cops, check out the weather or just plain listen around. These sensitive superhet receivers are just the ticket. They tune any 5 MHz portion of the band and have smooth variable squelch and plenty of speaker volume. Runs on 9V battery and performance that rivals the big rig! For a complete finished pro look, add our matching case and knob set with screened graphics.
FM communications receiver kit \$29.95
Specify band: FR-146 (2m), FR-6 (6m), FR-10 (10m), FR-220 (220 MHz)
Matching case & knob set, CFR \$12.95

SPEECH SCRAMBLER

Communicate in total privacy over phone or radio. Kit features full duplex operation using frequency inversion. Both mike and speaker or line in/out connections. Easy hookup to any radio, and telephone use requires no direct connection! Easy to build 2 IC circuit. Can also be used to scramble many 2-way radio signals. Finish your kit off with the handsome case & knob set.
SS-7 kit \$29.95
Matching case & knob set, CSS \$12.95

SHORTWAVE RECEIVER



Fantastic receiver that captures the world with just a 12" antenna! Can receive any 2 MHz portion from 4-11 MHz. True superhet has smooth varactor tuning, AGC, RF gain control, plenty of speaker volume and runs on a 9V battery. Fascinating Scout, school or club project provides hours of fun for even the most serious DXer. For the car, consider our shortwave converter. Two switchable bands (in 3-22 MHz range), each 1 MHz wide—tunable on your car radio dial. Add some interest to your drive home!
Shortwave receiver kit, SRI \$29.95
Shortwave converter kit, SCI \$27.95
Matching case set for SRI, CSR \$12.95
Matching case set for SCI, CSR \$12.95

FM STEREO TRANSMITTER

Run your own stereo FM station! Transmit a stable signal in the standard FM broadcast band throughout the house, dorm or neighborhood. Connects easily to line outputs on CD player, tape decks, etc. Runs on 9V battery, has internal whip antenna and external antenna jack. Add our case set for a "station" look!
FM-10 kit \$29.95
Matching case set, CFM \$12.95

AIRCRAFT RCVR

Hear exciting aircraft communications—pick up planes up to 100 miles away! Receives 110-136 MHz AM air band, smooth varactor tuning superhet with AGC, ceramic filter, adjustable squelch, excellent sensitivity and lots of speaker volume. Runs on 9V battery. Great for air shows or just hanging around the airport! New 30-page manual details pilot talk, too. Add case set for "pro" look.
AR-1 kit \$24.95
Matching case set, CAR \$12.95

PHONE ORDERS CALL
716-924-4560
FAX 716-924-4555
RAMSEY ELECTRONICS, INC. 793 Canning Parkway, Victor, NY 14564

that exceeds many commercially manufactured pieces of equipment.

CW Mode

In CW mode, transistor Q3 is keyed on and off by a CW key closure to ground. Q3 is held turned off by R18. When the key is closed R20 passes current to ground and lowers the voltage at the base of Q3, which places the base at a lower plus potential than the emitter. Q3 then turns on and supplies about 5 mA of current, limited by R19, to the diodes of the mixer. The double-balanced mixer now functions as a variable attenuator with its output proportional to the applied current. The chosen current level of 5 mA turns the mixer/attenuator fully on—a higher current level will damage the mixer diodes.

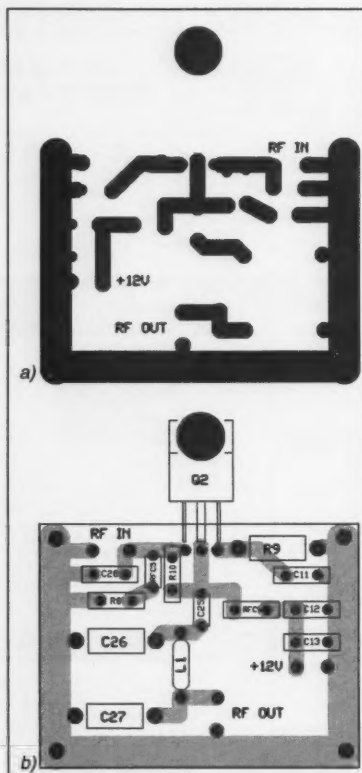


Figure 3. (a). PC board foil pattern for the 1-watt power amplifier board. (b). Parts placement.

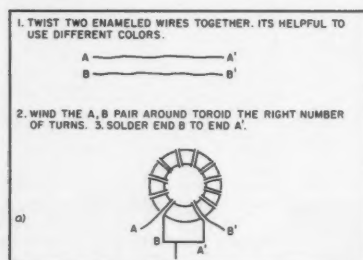


Figure 4. Bifilar winding details for toroid T2.

One modification I considered, but did not show on the schematic, is the installation of a 10k pot in series with R19. This pot would function as a drive control. I added this pot to my prototype and it performed very nicely; the power control was smooth and provided excellent control of the generated CW signal. C16 functions as a key click filter for transistor Q3, and capacitor C23 was added to bypass any carrier energy to ground that may appear at pins 3 and 4 of the mixer. Only audio in DSB or DC in CW mode should be present at this point. The addition of C23 made a noticeable improvement in the carrier suppression on my test models. This is another one of the parts which is not necessary for operation, but its presence improves the performance as measured with expensive test equipment.

The Audio Amplifier

The audio input from an electret microphone is amplified in the first section of IC U4 by a factor of five. Resistors R13, R17 and R12 set the gain to 5, while R11 and R12 form a voltage divider that applies a DC offset of 0.63 volts to the input of the op amp. About 100 mVp-p of audio from the microphone is capacitively coupled by C17 into the op amp. The gain of 5 amplifies the audio as well as the DC offset from the voltage divider, and results in an output at pin 1 of 0.5 Vp-p audio with a DC offset of about 3.15 VDC. This offset is necessary in order to use a single voltage supply op amp. By biasing the output of the op amp at one fourth of its DC operating potential, the required audio level of 500 mV is guaranteed to be free of distortion that might be caused by clipping of the audio signal if it were to approach one of the supply rails.

The second section of U4, used as a low-pass filter to limit the bandwidth of the generated DSB signal, is dependent upon the highest modulating frequency applied to the mixer. In human male voices, maximum energy is contained in the 300 Hz region of the audio spectrum, while for female voices, maximum energy is contained at about 3000 Hz. Since the DSB signal already consumes twice the precious spectrum space of a typical SSB station, a compromise must be struck on the maximum allowable audio frequency passed to the DSB mixer. I have chosen this limit to be 2500 Hz, which will provide excellent reproduction of the male voice and still provide faithful rendition of female voices. The driving concern here is to maintain a manageable bandwidth in the DSB signal that will cause a minimum of interference with others operating SSB equipment. Resistors R14, R15 and R16, in conjunction with capacitors C19 and C20, form a second order low-pass filter with a 12 dB per octave rolloff, starting at 2500 Hz. C21 is a DC-blocking capacitor which passes the audio from the amp/filter to the mixer via SW1. R21 reduces the 500 mV of audio drive to about 300 mVp-p for injection into the mixer.

MMIC Stage

Capacitor C5 is a DC-blocking capacitor which couples the DSB or CW signal from the output of the mixer to the input of IC U3, a monolithic microwave integrated circuit, or MMIC for short. This amplifier is one of a series of ICs sold by Mini-Circuits, who also manufactures the double-balanced mixer. The MAR-4 MMIC used here is rated at about 10 dB of gain and an output power of 10 mW. It replaces a small handful of parts at a cost of only \$2, all contained in a package the size of a pencil point! The body of this part contains a yellow dot over the input lead, while the opposite lead is the output and the two adjacent leads are both ground. Devices such as the MAR-4 MMIC are going to play an ever-increasing role in future ham construction projects. I have purposefully used one here to introduce the new hobbyist to this class of devices. They require care in handling and soldering due to their small size, but I have found them to be tougher both physically and electrically than one might expect.

The output of the MAR-4 is also the DC input pin, and this is accomplished by the RF choke feed composed of two ferrite beads in series with the current limiting resistor R2. Ample use of bypass capacitors is used throughout the transmitter on the power supply lines to insure that no stray RF is coupled from stage to stage by these lines. Bypass caps C4 and C2 are placed on the input and output pins of the 5-volt regulator U1 to prevent internal oscillations in the regulator chip. The +5-volt supply is used by the oscillator module, and is also used to supply the switched DC current to the mixer diodes in CW mode. Capacitors C18, C6, C13, C22, C24, C15 and C12 all function as supply line bypass capacitors. Their assortment of values insures that all frequencies from audio to RF on the supply lines will be effectively bypassed to ground. Several RF chokes are used throughout the transmitter to help isolate the supply lines of the different stages. This provides further protection from stray coupling that could lead to self-oscillation in the amplifier chain, and a certain "pink ticket"!

The Class-A Broadband Amplifier

Capacitor C7 couples the amplified signal from the MAR-4 to the base of transistor Q1, a low level class-A broadband amplifier. The stage gain of Q1 is set to about 13 dB by feedback action of C8 and R5, while R3, R4, and R6 set the bias to insure class-A operation. Transformer T2 is a broadband coupling device used to provide a coarse match to the final amplifier transistor Q2. R7 is a current limiting resistor, and C9 serves as the emitter bypass cap. The output level of Q1 is about 100 mW and is coupled to Q2 via C10. [Ed. Note: You can operate quite effectively at this power level if band conditions are good. Use of the optional 1-watt amplifier will allow you to work just about anywhere. Don't expect to break through DX pile-ups, however.]

Simplex Repeater System

- Handie Talkie ready
- 32 or 65 Second operation
- 2 mode operation, Announce or Repeater
- Commercial quality 3.2 kHz pass band
- Emergency coordination tests and drills
- Club meetings announcements
- Temporary repeater service's
- Range extenders
- Passing traffic
- Hiking, fishing, back packing, exploring
- Fox hunting
- Great wired into your mobile



It's Amazing what Simplex can do Better!

US Digital Co Direct 380 Rougeau Ave Winnipeg, MB, Canada R2C 4A2
US Money Order - Prompt Service
Certified Cheque - Prompt Service
Personal Cheques - Clearing Time
phone (204) 661-6859

CIRCLE 190 ON READER SERVICE CARD

HUGE 100 PAGE CATALOG

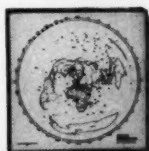
- Communications Receivers
- Portable Receivers
- Scanners
- Amateur HF Transceivers
- VHF-UHF Transceivers
- HT's and Mobiles
- Amateur and SWL Antennas
- Accessories and Parts
- RTTY and FAX Equipment
- Books and Manuals

This catalog includes prices!



Universal Radio
6830 Americana Pkwy. 73
Reynoldsburg, OH 43068
Tel. 614 866-4267

BEAM INDICATOR



- BRIGHT LED INDICATORS WITH 5" RESOLUTION
- ADJUSTABLE BEAM WIDTH AND LONG PATH INDICATION
- CUSTOM GREAT CIRCLE MAP ON YOUR QTH
- DECORATIVE 16" x 16" x 1" FRAME

See your beam's coverage on a custom Great Circle Map with a simple rotator connection.



\$189.95*

GREAT CIRCLE MAPS

Four color maps centered on your QTH

- Laminated 22" or 16" \$35.00*
- Framed 16" \$59.95*
- Framed 21" \$74.95*

*S & H included (continental U.S.)
CA Residents please add 7.25% sales tax

Call or write for more information.

VECTOR CONTROL SYSTEMS

1655 N. Mountain Ave., Suite 104-45
Upland, CA 91786 • (714) 985-6250

CIRCLE 78 ON READER SERVICE CARD

NextDay

Baraboo, Wisconsin
Shut County
KOZZ

Info \$1
AntennasWest
(801) 373-8425

QSLs

Two-Color
Rainbow Assortment

We Ship	NextDay	2nd Day	ASAP
100	\$29.95	\$24.95	\$19.95
200	\$39.95	\$34.95	\$29.95
400	\$49.95	\$44.95	\$39.95
500	\$54.95	\$49.95	\$44.95
1000	\$99.95	\$89.95	\$79.95

All orders pld 2nd day air / priority mail.
For overnight air delivery add \$10.
Box 50062-S, Provo, UT 84605

CIRCLE 5 ON READER SERVICE CARD

Say You Saw It in 73!

Factory Authorized Dealer & Service For

**KENWOOD
YAesu
ICOM**

Call Us For
Great Prices & Great Service

TOLL FREE ORDER LINE 1-800-344-3144
Continental U.S. & Texas

KOMAR, INC. SAN ANTONIO TEXAS
THE HAM CENTER
SALES AMATEUR RADIO SERVICE

5730 Mobad San Antonio, TX 78238 (512) 680-6110
FAX (512) 647-8007

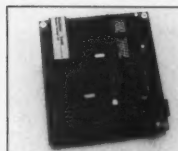
INDOOR/WINDOW MOUNT VERTICAL DIPOLE

- CR-6 Set of coil ribs\$3.90
- ID-K Indoor Vertical Dipole, Kit\$49.50
- ID-C Indoor Vertical Dipole, Complete\$79.50
- WM-2 Window Mount Assembly\$32.50
- C3040 Add-On coils for 30, 40 meters\$39.50

Postpaid USA PA residents add 6%
Urban Antennas, Inc.
Bryn Athyn, PA 19009-0662 • (215) 947-0235

CIRCLE 163 ON READER SERVICE CARD

Natural Voice Playback Board



- Repeater Identifiers
- Contest Stations
- Site Alarms
- Remote Telemetry
- Weather Stations
- Multiple Languages
- Emergency Announcements

DataVoice - DV-64

Add a *Recorded Natural Voice* to your system or equipment. Voice vocabularies or multiple phrases up to 1 minute in a Natural Voice is saved in Non-Volatile E-Prom memory. (If power is removed the recordings will not be lost). We'll record your message(s) in a male or female voice - or - you can record the library by using the optional SDS-1000 development board on an IBM or compatible computer.

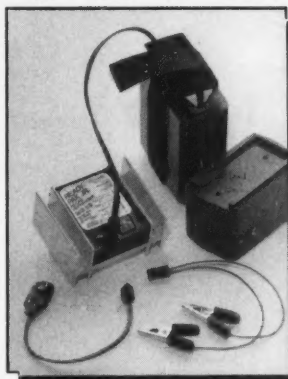
- Parallel Input Word Select
- 500 ma Keyline Output
- 32 Kb sampling rate
- Multiple Modes
- 30 sec - 30 minute Timers
- 8 ohm Audio output
- 600 ohm Audio output
- +9v to +14v Supply
- Size: 4.00" x 4.25"
- Connectors Included

Price \$169.00 Single Qty (programmed)

Palomar Telecom, Inc.
300 Enterprise St, Suite E
(619) 746-7998

CIRCLE 139 ON READER SERVICE CARD

ELIMINATE NI-CAD BATTERY PROBLEMS!



WITH Ready-Pak Jr. THE DECHARGING SYSTEM

Ready-Pak Jr. cures common Ni-Cad "Memory" by properly discharging Ni-Cad cells and packs. Automatically stops discharge at proper level, then balances and equalizes cell voltages! For AAA, AA, C & D groupings, or Ni-Cad packs which are between 70 MaH and 1200 MaH. Mobile radios, phones, RC hobby, cordless tools, etc. all use Ni-Cads... get 'em back in shape with **Ready-Pak Jr.**

EACH UNIT COMES WITH THESE CONNECTION SYSTEMS:

Alligator clips, 9v battery snap, and Adjustable Velcro system to fit all X-celver and cellular flat packs.



FOR CAMCORDERS!



Ask for our
**Ready-Pak II
Decharger.**
All 6, 9, 12v packs

\$44.95

CHOOSE FROM 3 MODELS!

- Original Unit
for 3.6, 4.8, 6, 7.2 Volt
- Low Range Unit
for 7.2, 8.4, 9.6, 10.8 volt
- High Range Unit
for 9.6, 10.8, 12, 13.2 volt

Each Unit Only
\$44.95
S+H included

Chk. M.O.
(FL add sales tax)

STAR ELECTRONICS

227 Pond Pine Street
Tallahassee, Florida 32310
(904) 385-9893

Phone Hours:
11 am to 7 pm EST Mon-Fri
MADE IN USA

CIRCLE 142 ON READER SERVICE CARD

73 Amateur Radio Today • July, 1992 23

The Final Amplifier

The optional final amplifier is also operated class-A to insure linearity. This results in a substantial amount of heat dissipation by the transistor; therefore, Q2 is fitted with a heat sink. The power amplifier is built on a separate PC board to allow easy attachment to whatever form of heat sink you wish to use, such as a chassis box or plate of aluminum. The tab of Q2 must be insulated from the heat sink due to the fact that the tab is internally connected to the collector. Resistors R10, R8 and R9 set the stage bias, while C11 is the emitter bypass cap. Choke RFC4 provides a DC path for the bias current, but acts as a high impedance to the input RF. RFC5 supplies the DC feed to Q2 and isolates the RF from the power bus. The gain of the final stage is about 10 dB, which results in an output power of 1 watt PEP. The CW output is slightly higher at about 1.5 watts RMS. C25 is the DC blocking cap for Q2, and passes the RF to a pi-network composed of C26, L1, and C27, which helps with harmonic attenuation. This completes the circuit description. I cannot claim credit for the basic design of the last two amplifier stages. These are patterned after ones in the *Solid State Handbook* from the ARRL.

Construction

Assembly of the exciter (see Figure 2) should be done a stage at a time, starting with the oscillator and progressing through to the amp Q1. It will be helpful to monitor your progress by the use of a SSB receiver, tuned to 28.322 MHz, as you assemble each stage. Remember that the oscillator module is generating a hefty 40 mW by itself and may give a significant signal to the receiver. Switch S1 can be mounted on the front of the mini-box which you house the transmitter in, along with a jack for connecting the microphone. I used a garden variety electret microphone which contains two wires: one black wire to ground, and a red wire connected to C17, also in series with a 10k resistor to +12 volts. Electrets contain an on-chip amplifier and must have a source of DC to power them. Alternately, you could supply a source of 100 mVp-p signal from an audio amp into C17. Some provision must be made to switch the +12 volt supply on and off to the transmitter. This could be a simple toggle switch on the front panel, or a PTT relay, activated by a button on the mike. Remember, you must turn off the transmitter in order to receive! No provisions have been made for a drive control in DSB mode, but a pot connected to the mike input could be used to set the maximum modulation level. With a little practice monitoring your own signal you will have no trouble finding a voice level which gives clear, undistorted audio that is less than 100% modulation.

In case of trouble, the following voltage checks should help you out. With a good quality scope you should read 0.6 Vp-p RF at pin 1 of the mixer, 0.6 Vp-p RF at the out-

put of U3, 7 Vp-p RF at the collector of Q1, and 20 Vp-p RF at the collector of Q2. These measurements are made in CW mode. The mike amp should deliver 0.3 Vp-p of audio to pins 3,4 of the mixer with 100 mVp-p of audio input to the mike jack. You can operate with just the exciter by hooking the antenna directly to the output of the exciter PC board. For an additional boost, just run a short run of RG-174 coax between the exciter and the power amplifier board (see

Figure 3) and hook up your antenna to the PA output.

This simple, low-cost transmitter can be put to a variety of uses, such as a backpacking rig, or even a 10m DSB transmitter for balloon flights. By utilizing a common frequency, this unit can create a breeding ground for experimenters, and keep you in touch with like-minded others.

I hope to start work on a companion receiver soon!

Parts List

R1,R2	150 ohm resistor
R3	330 ohm resistor
R4,R10	510 ohm resistor
R5	470 ohm resistor
R6	39 ohm resistor
R7	10 ohm resistor
R8	100 ohm resistor
R9	2 ohm, 1/2-watt carbon resistor
R11	180k carbon resistor
R12,R14,R15,R17,R18	10k resistor
R13	47k resistor
R16	20k resistor
R19,R20	1k resistor
R21	220 ohm resistors
C1,C6,C10,C12,C15,C25,C22	0.01 μ F 100-volt ceramic cap
C2,C4,C8,C9,C11,C16	0.1 μ F 50-volt monolithic cap
C3	120 pF 50-volt ceramic cap
C5,C7,C23	0.001 μ F 50-volt ceramic cap
C13,C18,C24	10 μ F 16-volt electronic cap
C14	not used
C17	1 μ F 16-volt electrolytic cap
C19	0.012 μ F 50-volt monolithic cap
C20	0.0039 μ F 50-volt monolithic cap
C21	33 μ F 16-volt electrolytic cap
C26,C27	100 pF 100-volt silver mica cap
C28	220 pF 100-volt ceramic cap
RFC1,RFC2,RFC3	25 turns #28 wire on a 100k 1/4-watt resistor
RFC4,RFC5	25 turns #28 on T37-6 core
T1	25T primary 8T secondary #28 on T37-6
T2	13T bifilar #28 wire on T37-6 core (see Figure 4)
L1	8T #24 wire on T37-6 core
Q1	2N3866 transistor
Q2	2SC2075 transistor (available from RF Parts)
Q3	2N3906 transistor
U1	78L05 +5-volt regulator
U2	SBL-1 mixer, Mini Circuits
U3	MAR-1 amp, Mini Circuits
U4	LM324 op amp
OSC	28.322 MHz clock oscillator, Digi-Key# CTX-128 (see Note 2).
FB	ferrite bead, Amidon Associates

Note 1: Etched and drilled PC boards are available from FAR Circuits, 18N640 Field Court, Dundee IL 60118. The main transmitter board is available for \$5 and the final amplifier for \$3. You can order both boards for a combo price of \$6. Add \$1.50 per order for postage/handling.

Note 2: Oscillator modules on custom frequencies are available for \$12.80 from Cal Crystal Labs, Inc., 1142 N. Gilbert, Anaheim CA 92801; (714) 991-1580. The part number is CCO-100A-xx.xxxMHz (replace the x's with your desired frequency).

ASTRON POWER SUPPLIES

• HEAVY DUTY • HIGH QUALITY • RUGGED • RELIABLE •



MODEL VS-50M

SPECIAL FEATURES

- SOLID STATE ELECTRONICALLY REGULATED
- FOLD-BACK CURRENT LIMITING Protects Power Supply from excessive current & continuous shorted output
- CROWBAR OVER VOLTAGE PROTECTION on all Models except RS-3A, RS-4A, RS-5A, RS-4L, RS-5L
- MAINTAIN REGULATION & LOW RIPPLE at low line input Voltage
- HEAVY DUTY HEAT SINK • CHASSIS MOUNT FUSE
- THREE CONDUCTOR POWER CORD except for RS-3A
- ONE YEAR WARRANTY • MADE IN U.S.A.

PERFORMANCE SPECIFICATIONS

- INPUT VOLTAGE: 105-125 VAC
- OUTPUT VOLTAGE: 13.8 VDC \pm 0.05 volts (Internally Adjustable: 11-15 VDC)
- RIPPLE Less than 5mv peak to peak (full load & low line)
- All units available in 220 VAC input voltage (except for SL-11A)

SL SERIES



MODEL	Colors Gray Black	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H x W x D	Shipping Wt. (lbs.)
SL-11A	• •	7	11	2 3/4 x 7 1/2 x 9 1/4	11

- LOW PROFILE POWER SUPPLY

RS-L SERIES



MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H x W x D	Shipping Wt. (lbs.)
RS-4L	3	4	3 1/2 x 6 1/2 x 7 1/4	6
RS-5L	4	5	3 1/2 x 6 1/2 x 7 1/4	7

- POWER SUPPLIES WITH BUILT IN CIGARETTE LIGHTER RECEPTACLE



RM SERIES MODEL RM-35M

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H x W x D	Shipping Wt. (lbs.)
RM-12A	9	12	5 1/4 x 19 x 8 1/4	16
RM-35A	25	35	5 1/4 x 19 x 12 1/2	38
RM-50A	37	50	5 1/4 x 19 x 12 1/2	50
RM-60A	50	55	7 x 19 x 12 1/2	60

- Separate Volt and Amp Meters

RS-A SERIES



MODEL RS-7A

MODEL	Colors Gray Black	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H x W x D	Shipping Wt. (lbs.)
RS-3A	• •	2.5	3	3 x 4 1/4 x 5 3/4	4
RS-4A	• •	3	4	3 1/4 x 6 1/2 x 9	5
RS-5A	• •	4	5	3 1/2 x 6 1/2 x 7 1/4	7
RS-7A	• •	5	7	3 3/4 x 6 1/2 x 9	9
RS-7B	• •	5	7	4 x 7 1/2 x 10 1/4	10
RS-10A	• •	7.5	10	4 x 7 1/2 x 10 1/4	11
RS-12A	• •	9	12	4 1/2 x 8 x 9	13
RS-12B	• •	9	12	4 x 7 1/2 x 10 1/4	13
RS-20A	• •	16	20	5 x 9 x 10 1/2	18
RS-35A	• •	25	35	5 x 11 x 11	27
RS-50A	• •	37	50	6 x 13 3/4 x 11	46

RS-M SERIES



MODEL RS-35M

MODEL	Continuous Duty (Amps)	ICS* (Amps)	Size (IN) H x W x D	Shipping Wt. (lbs.)
RS-12M	9	12	4 1/2 x 8 x 9	13
RS-20M	16	20	5 x 9 x 10 1/2	18
RS-35M	25	35	5 x 11 x 11	27
RS-50M	37	50	6 x 13 3/4 x 11	46

- Switchable volt and Amp meter

- Separate volt and Amp meters

VS-M AND VRM-M SERIES



MODEL VS-35M

- Separate Volt and Amp Meters • Output Voltage adjustable from 2-15 volts • Current limit adjustable from 1.5 amps to Full Load

MODEL	Continuous Duty (Amps)			ICS* (Amps)	Size (IN) H x W x D	Shipping Wt. (lbs.)
	@13.8VDC	@10VDC	@5VDC	@13.8V		
VS-12M	9	5	2	12	4 1/2 x 8 x 9	13
VS-20M	16	9	4	20	5 x 9 x 10 1/2	20
VS-35M	25	15	7	35	5 x 11 x 11	29
VS-50M	37	22	10	50	6 x 13 3/4 x 11	46

- Variable rack mount power supplies

VRM-35M	25	15	7	35	5 1/4 x 19 x 12 1/2	38
VRM-50M	37	22	10	50	5 1/4 x 19 x 12 1/2	50

RS-S SERIES



MODEL RS-12S

- Built in speaker

MODEL	Colors Gray Black	Continuous Duty (Amps)	ICS* Amps	Size (IN) H x W x D	Shipping Wt. (lbs.)
RS-7S	• •	5	7	4 x 7 1/2 x 10 1/4	10
RS-10S	• •	7.5	10	4 x 7 1/2 x 10 1/4	12
RS-12S	• •	9	12	4 1/2 x 8 x 9	13
RS-20S	• •	16	20	5 x 9 x 10 1/2	18

Calibrated Signal Generator

*An accurate RF source from
400 kHz to 33 MHz at the twist of a dial.*

by John Pivnichny N2DCH

An accurately calibrated signal generator is a worthwhile instrument to have around the shack for equipment checkout. If you like to experiment with circuits or build your own equipment, you will often need a source of RF signals. This generator can produce a signal anywhere from 400 kHz to 33 MHz at the twist of its linearly calibrated dial. Output level is adjustable from zero to over 200 mV RMS.

Calibration

The most important part in the whole generator is the tuning capacitor. This is what permits a linearly calibrated dial. Fair Radio Sales sells a beautiful surplus worm-gear-driven 25-220 pF unit which was appropriately enough removed from a signal generator. Its rotor plates have the unusual shape shown in Figure 1. For this project the arc indicated is the only portion used. My preliminary measurements showed that linear frequency operation is possible with a 1.2:1 frequency ratio in exactly 30 turns of the worm gear drive shaft. I have no idea what the rest of this unusually shaped rotor was intended for.

I then determined the actual frequency deviation from a straight line dial by taking frequency counter readings to the nearest kHz at every turn of the capacitor drive shaft. See Figure 2 for the results. A positive error means the frequency is higher than expected at that turn of the shaft. The tuning range is 15 to 18 MHz.

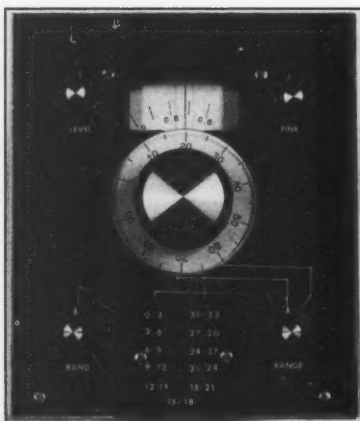


Photo A. Front panel of the signal generator.

All errors—capacitor plate shape, worm gear, circuit stray reactances, and the author's ability to position the shaft angle—are included. The net result is that the capacitor produces a straight line frequency tuning with less than 9 kHz maximum error from 15 to 18 MHz.

The oscillator circuit uses a CA3028 integrated circuit from RCA. Calibration is done by setting the low frequency end of the dial to exactly 15 MHz with the tuning slug in the variable inductor L1.

Then tune the dial to the top and bring the frequency to exactly 18 MHz with the variable capacitor, then go back to the bottom and re-set to 15 MHz with the inductor, etc..

Although there is interaction between the two settings, this procedure of using the inductor at the low end and the capacitor at the high end will converge. Less adjustment will be required at each step, except the first one, until both ends of the dial line up at exactly 15 and 18 MHz. It is possible to cover this range in exactly 30 turns of the shaft and with less than 9 kHz of error at any point in the whole range.

Dial Construction

The main tuning knob covers 100 kHz per turn. A clear plastic skirt 2.5" in diameter with a paper dial divides this up into markings every 5 kHz. I used a 1.75" diameter knob and glued the skirt onto the back of the knob with plastic pipe cement, then fastened the paper dial to the back of the skirt with Scotch tape.

A large plastic pulley 4.5" in diameter is used to hold the main dial, which has 31 evenly spaced graduations marked in tenths from 0 to 3.0. A full-size pattern of both this dial and the knob skirt dial is reproduced in Figure 3. These can be repro-

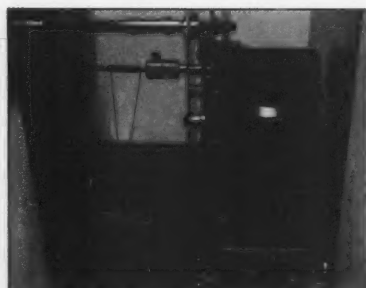


Photo B. Dial cord arrangement, right side.

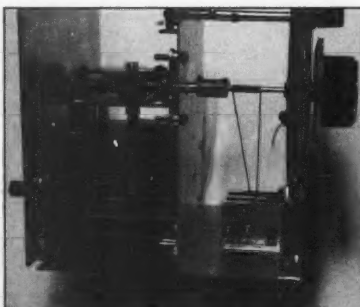


Photo C. Dial drive as viewed from the left side.

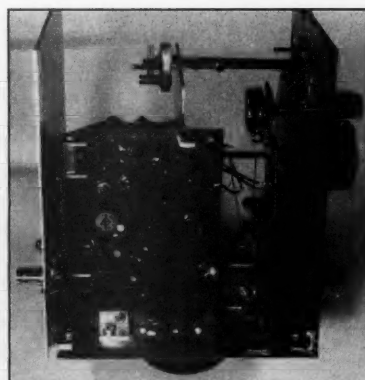


Photo D. Inside view of the generator showing the main circuit in place.

COMMUNICATIONS ELECTRONICS INC.

Emergency Operations Center

has expanded to our new two acre facility and World Headquarters. Because of our growth, CEI is now your one stop source for emergency response equipment. When you have a command, control or communications need, essential emergency supplies can be rushed to you by CEI. As always, for over twenty three years, we're ready, willing and able to help. For 1992, we're introducing new products from Uniden, Shinwa, Cobra, Ranger Communications, Grundig, Sangean, Magnavox, Icom and RELM.

NEW! Shinwa SR001-B

List price \$799.95/CE price \$479.95/SPECIAL Continuous coverage from 25.000 through 999.995 MHz. If you're looking for an excellent synthesized scanner designed for mobile surveillance use, the new Shinwa SR001 scanner offers features never before offered at such a low price. When you purchase this wide band scanner from CEI, you'll get a free infrared wireless remote control that allows you to control your scanner from over 200 feet away. Selectable frequency steps of 5.0/10.0/12.5/20.0/25.0/50.0 or 100.0 KHz. are available. Dual antenna inputs terminating in an "N-type" and "BNC" connectors are included. Other features include 200 memory channels grouped in 10 banks of 20 channels, easy to read multi color LCD display, lithium battery for memory back-up, 35 channel per second high speed scanning, priority, timer and even an alarm to alert you to transmissions on your choice of one special frequency. We even include a mobile mounting bracket. The SR001 can be used for base station use with the purchase of the ACS-B 12 volt DC power supply for only \$34.95 each. A great sounding external speaker #SPE-B is available for only \$24.95.

SHINWA POCKET PAGERS

The fire department hazardous materials response teams and police department SWAT crews that need reliable radio alerting systems, stake their lives on Shinwa. We offer a two-tone pocket pager with monitor feature and even a voice storage option at an affordable price. To order, we need your paging frequency as well as tone red frequencies. For other configurations or two-way radio information, please fax us your specifications to 313-663-8888 or phone 313-996-8888.

NEW! ICOM ICR1-B

List price \$799.95/CE price \$519.95/SPECIAL Continuous coverage from 100 kHz through 1.300 GHz. The ICOM ICR1 keeps you in touch with the world when you're on the go. The palm-size ICR1 is equipped with AM, FM and wide-FM modes to fully answer your monitoring needs. With 100 memory channels and a dual frequency selection system, you get a top-class communications receiver. Not only can you program scan searches only for signals within a specified frequency range, it's also possible to write frequencies of received stations automatically into memory. In addition, unwanted frequencies can be skipped. Order ICBC72-B battery rapid charger for \$99.95 and a BP84-B 1,000 ma. battery pack for \$74.95.

NEW! ICOM ICR100-B

List price \$799.95/CE price \$579.95/SPECIAL Continuous coverage from 100 kHz. through 1856 MHz. Now you can bring a wider world of broadcasting, VHF air and marine bands, emergency services and many more communications into your vehicle. Icom's advanced ICR100 fully covers all the stations worth hearing with up to 100 memory channels and a multitude of features.

SCANNERS/CB/RADAR UNIDEN

PR0310E-B Uniden 40 Ch. Portable/Mobile CB	\$72.95
PR0330E-B Uniden 40 Ch. Remote mount CB	\$99.95
GRANT-B Uniden 40 channel SSB CB mobile	\$152.95
WASHINGTON-B Uniden 40 Ch. SSB CB base	\$229.95
PC122-B Uniden 40 channel SSB CB mobile	\$113.95
PC86A-B Uniden 40 channel CB Mobile	\$78.95
PR0510XL-B Uniden 40 channel CB Mobile	\$39.95
PR0520XL-B Uniden 40 channel CB Mobile	\$54.95
PR0535E-B Uniden 40 channel CB Mobile	\$69.95
PR0538W-B Uniden 40 ch. weather CB Mobile	\$78.95
PR0810E-B Uniden 40 channel SSB CB Base	\$174.95

UNIDEN RADAR DETECTORS

RD3000ZX-B Uniden 3 band suction mount radar	\$119.95
RD4000ZX-B Uniden 3 band radar detector	\$109.95
RD80-B Uniden 2 band radar detector	\$64.95
CARD-B 2 band credit card size radar detector	\$89.95
RD3XL-B Uniden 3 band radar detector	\$109.95
RD9XL-B Uniden "micro" size radar detector	\$69.95
RD27-B Uniden visor mount radar detector	\$39.95



19 PLUS-B Cobra CB radio	\$36.95
18RV-B Cobra CB radio	\$54.95
41PLUS-B Cobra CB radio	\$72.95
70LTD-B Cobra remote mount CB radio	\$99.95
19LTD-B Cobra Classic series CB radio	\$44.95
21LTD-B Cobra Classic series CB radio	\$54.95
25LTD-B Cobra Classic series CB radio	\$89.95
29LTD-B Cobra Classic series CB radio	\$109.95
146GTL-B Cobra AM/SSB CB radio	\$129.95
146GTL-B Cobra AM/SSB CB radio	\$149.95
90LTD-B Cobra Base station	\$89.95
142GTL-B Cobra AM/SSB Base station	\$199.95
200GTL-B Cobra Deluxe AM/SSB Base station	\$379.95

COBRA RADAR DETECTORS

RD3163-B Cobra 3 band radar detector	\$109.95
RD3175-B Cobra 3 band radar detector	\$129.95
RD3179-B Cobra 3 band radar detector	\$139.95
RD3183-B Cobra 3 band radar detector	\$139.95

Bearcat 200XLT-B

List price \$509.95/CE price \$239.95/SPECIAL 12 Band, 200 Channel, Handheld, Search, Limit, Hold, Priority, Lockout Frequency range: 29-54, 118-174, 406-512, 806-956 MHz. Excludes 823.9875-849.0125 and 868.9875-894.0125 MHz. The Bearcat 200XLT sets a new standard for handheld scanners in performance and dependability. This full featured unit has 200 programmable channels with 10 scanning banks and 12 band coverage. If you want a very similar model without the 800 MHz. band and 100 channels, order the BC100XLT-B for only \$179.95. Includes antenna, carrying case belt loop, ni-cad battery pack, AC adapter and ear-phone. Order your scanner from CEI today.

Bearcat 800XLT-B

List price \$549.95/CE price \$239.95/SPECIAL 12-band, 40 Channel, Nothing excluded in the 800 MHz. band. Bands: 29-54, 118-174, 406-512, 806-956 MHz. If you do not need the 800 MHz. band, order the Bearcat 210XLT-B for the special CEI price of \$139.95.

Magnavox® Satellite Phone

CE price \$48,880.00/Special order - allow 45 days for delivery. When war broke out in Iraq, you heard all the action because CNN had a satellite telephone. When a disaster such as an earthquake or a hurricane strikes your community and communications are disrupted, you can depend on instant reliable communications, just like CNN did using your Magnavox MagnaPhone. Inmarsat communication satellites are in geostationary orbit along the equator. They beam two-way voice and data transmissions between your satellite phone and fixed earth stations. In most instances, telephone calls are dialed directly once you have selected the satellite serving your location. No matter where you are on the planet, the MagnaPhone automatically selects the Land Earth Station (LES) nearest the destination called. This makes placing a call as easy as using a standard telephone. Dual ID numbers permit a separate Inmarsat telephone number to be used to route calls to a fax machine or a computer data line. For telephone, telefax, fax and data communications anywhere in the world, the new MX2020P MagnaPhone is the most compact Inmarsat-A, Class 1 terminal available today. Like a cellular phone, airtime will be billed to your account. The new MagnaPhone weighs just 47 lbs (21 kg), including the antenna. Add the optional ruggedized case (only \$950.00) and it can travel as airline baggage on commercial carriers. When you arrive at your destination, installation can be done in less than five minutes. For more information call our Emergency Operations Center at 313-996-8888.

RELM UC202-B 2 Watt transceiver on 154.57 MHz	\$114.95
RELM RH256NB-B 25 Watt VHF transceiver	\$299.95
RC2950-B Ranger Comm. 25 Watt 10 Meter xcvr	\$234.95
MR8100-B Uniden surveillance scanner .CALL FOR PRICE	
BC55XLT-B Bearcat 10 channel scanner	\$114.95
AD100-B Plug in wall charger for BC55XLT	\$14.95
P5001-B Cigarette lighter cable for BC55XLT	\$14.95
VC001-B Carrying case for BC55XLT	\$14.95
BC70XL-B Bearcat 20 channel scanner	\$139.95
BP70-B Ni-Cad battery pack for BC70XL scanner	\$39.95
BC142XL-B Bearcat 10 channel 10 band scanner	\$84.95
BC147XL-B Bearcat 16 channel 11 band scanner	\$94.95
BC127XL-B Bearcat 20 channel 11 band scanner	\$124.95
BC177XL-B Bearcat 16 channel 11 band scanner	\$129.95
BC590XL-B Bearcat 100 channel 11 band scanner	\$194.95
BC760XL-B Bearcat 100 channel 12 band scanner	\$254.95
BC002-B CTCSS tone board for BC590/760XL	\$54.95
BC003-B Switch assembly for BC590/760XL	\$22.95
BC855XL-B Bearcat 50 channel 12 band scanner	\$174.95
BC560XL-B Bearcat 16 channel 10 band scanner	\$94.95
BP205-B Ni-Cad battery pack for BC200/100XL	\$39.95
TRAVELLER2-B Grundig shortwave receiver	\$84.95
COSMOPOLIT-B Grundig shortwave receiver	\$179.95
SATELIT7500-B Grundig shortwave receiver	\$499.95
SATELIT650-B Grundig shortwave receiver	\$349.95
ATS800-B Sangean shortwave receiver	\$89.95
ATS803-B Sangean shortwave receiver	\$159.95
74102-B Midland emergency weather receiver	\$34.95
7112-B Midland CB with VHF weather & antenna	\$66.95
77118-B Midland CB mobile with VHF weather	\$62.95
77913-B Midland CB portable with VHF weather	\$79.95
76300-B Midland CB base station	\$92.95
NPD-B Uniden National Police Directory	\$19.95
FBE-B Frequency Directory for Eastern U.S.A.	\$14.95
FBW-B Frequency Directory for Western U.S.A.	\$14.95
RFD1-B MI, IL, IN, KY, OH, WI Frequency Directory	\$14.95
RFD2-B CT, ME, MA, NH, RI, VT Directory	\$14.95
RFD3-B DE, DC, MD, NJ, NY, PA, VA, WV Directory	\$14.95
RFD4 AL, AR, FL, GA, LA, MS, NC, PR, SC, TN, VI	\$14.95
RFD5 AK, ID, IA, MN, MT, NE, ND, OR, SD, WA, WY	\$14.95
RFD6 CA, NV, UT, AZ, HI, GU Frequency Directory	\$14.95
RFD7-B CO, KS, MO, NM, OK, TX Freq. Directory	\$14.95
PWB-B Passport to World Band Radio	\$16.95
ASD-B Airplane Scanner Directory	\$14.95
TSG-B "Top Secret" Registry of U.S. Govt. Freq.	\$16.95
TTG-B Tune in on Telephone Calls	\$14.95
CBH-B Big CB Handbook/AM/FM/Freeband	\$14.95
TIC-B Techniques for Intercepting Communications	\$14.95
EEC-B Embassy & Espionage Communications	\$14.95
SMHV1-B Scanner Modification Handbook/Volume 1	\$18.95
SMHV2-B Scanner Modification Handbook/Volume 2	\$18.95
LIN-B Latest Intelligence by James E. Tunnell	\$17.95
A60-B Magnet mount mobile scanner antenna	\$39.95
A70-B Base station scanner antenna	\$39.95
USAMM-B Mag mount VHF ant. w/ 12' cable	\$39.95
USAK-B 3/4" hole mount VHF antenna w/ 12' cable	\$34.95
Add \$5.00 shipping for all accessories ordered at the same time.	
Add \$15.00 shipping per radio and \$6.00 per antenna.	

BUY WITH CONFIDENCE

Michigan residents please add 4% sales tax or supply your tax I.D. number. Written purchase orders are accepted from approved government agencies and most well rated firms at a 10% surcharge for net 10 billing. All sales are subject to availability, acceptance and verification. Prices, terms and specifications are subject to change without notice. All prices are in U.S. dollars. Out of stock items will be placed on backorder automatically or equivalent product substituted unless CEI is instructed differently. Shipments are F.O.B. CEI warehouse in Ann Arbor, Michigan. No COD's. Not responsible for typographical errors.

Mail orders to: Communications Electronics, Box 1045, Ann Arbor, Michigan 48106 U.S.A. Add \$15.00 per radio for U. S. P. ground shipping and handling in the continental U.S.A. For Canada, Puerto Rico, Hawaii, Alaska, or APO/FPO delivery, shipping charges are two times continental U.S. rates. If you have a Discover, Visa, American Express or MasterCard, you may call and place a credit card order. 5% surcharge for billing to American Express. For credit card orders, call toll-free in the U.S. Dial 800-USA-SCAN. For information call 313-996-8888 FAX anytime, dial 313-663-8888. Order from Communications Electronics today. Scanner Distribution Center™ and CEI logos are trademarks of Communications Electronics Inc. Sale dates 12/2/91 through 5/31/92 Add #121591-B Copyright © 1992 Communications Electronics Inc.

For more information call

1-313-996-8888

Communications Electronics Inc.

Emergency Operations Center

P.O. Box 1045, Ann Arbor, Michigan 48106-1045 U.S.A.

For orders call 313-996-8888 or FAX 313-663-8888

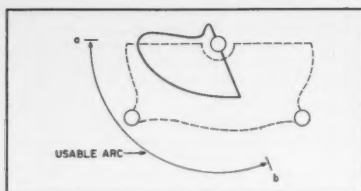


Figure 1. Capacitor rotor shape.

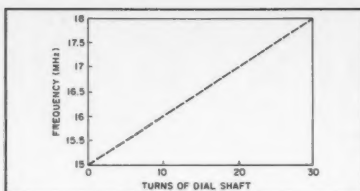


Figure 2. Capacitor error.

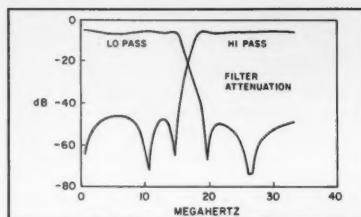
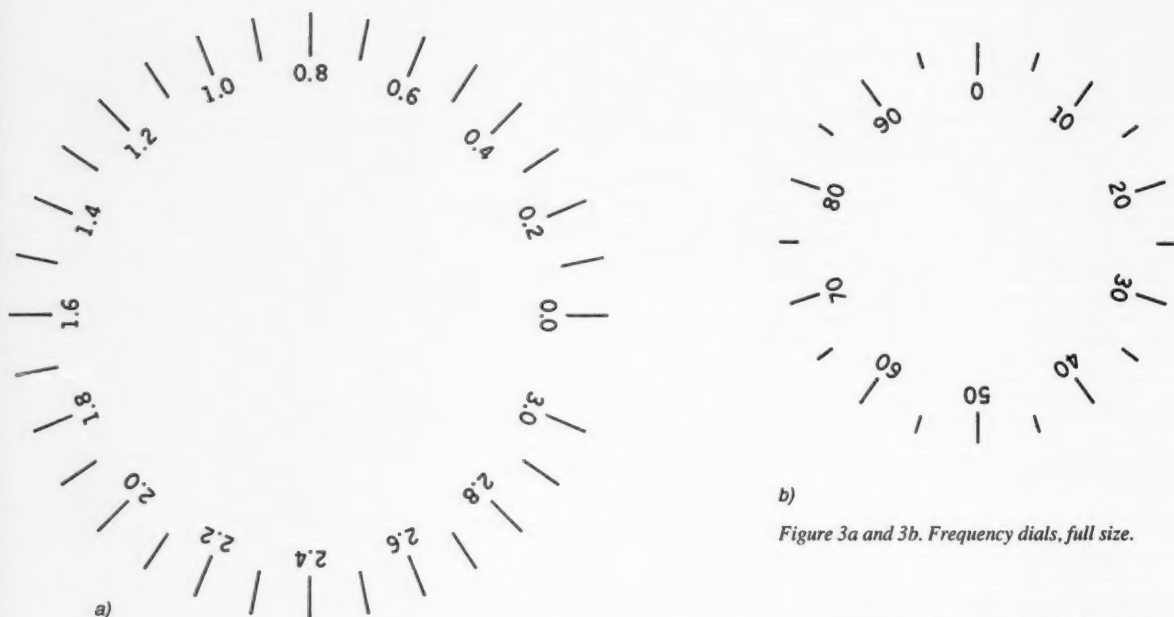


Figure 5. Filter responses.



b)

Figure 3a and 3b. Frequency dials, full size.

duced on a copy machine for use in building the signal generator. A frequency in the 15 to 18 MHz range is set by adding the main dial reading in MHz to 15, then reading the kHz from the knob skirt.

The main dial pulley is driven by a

string arrangement as shown in Figure 4, with 30 turns around a 1/8" shaft wound from back to front as the tuning range is covered. Two 1"-diameter plastic pulleys feed the cord up and across two small brass guide pulleys and onto the large dial.

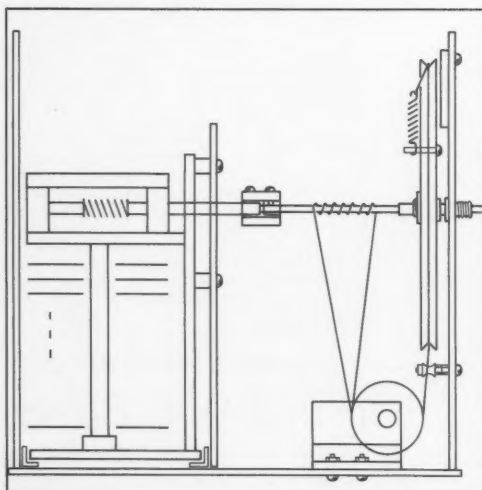


Figure 4. Dial cord arrangement.

Frequency Mixing

The remainder of the high frequencies from 0.4 to 33 MHz is covered by mixing this 15 to 18 MHz base range with a switched fixed frequency oscillator in 10 additional bands of 3 MHz each. Each fixed frequency provides two bands, one above and one below the base range. For example, mixing the base range with a 6 MHz oscillator signal produces 9 to 12 and 21 to 24 MHz ranges. The upper or lower band is selected by switching in either a high-pass or low-pass filter, described later in this article. Only five fixed frequencies are re-

quired: 3, 6, 9, 12, and 15 MHz.

An MPF102 FET transistor circuit is used with five separate slug-tuned tank circuits to generate the fixed frequencies.

The five tank circuits can be built and checked with your dipper before soldering into place on a piece of single-sided circuit board mounted behind the six-position band switch.

Final setting is done after the cover is in place by adjusting the slugs through holes drilled in the left side of the cover.

See the parts list for suggested tank circuit information. However, you can use practically any coil forms in your junk box by winding a trial set of turns for a particular capacitor, checking the frequency on your dipper, and then removing turns or rewinding with additional turns to get to the proper frequency.

In addition to the desired sum and difference frequencies just described, other unwanted signals may be produced in a mixer circuit. My use of the MC1496 doubly balanced mixer greatly eliminates both fundamentals, the fixed frequency and the 15-18 MHz adjustable one. Even harmonics of both are also balanced out. In addition, signal input levels to the mixer are properly controlled to keep them below 60 mV in order to minimize third order mixing products.

The mixer is unbalanced by shifting the DC bias of one carrier input when the 15-18 MHz band is selected in order to let that signal come through without mixing. Power to the fixed oscillator circuit is turned off, and the filters are bypassed when selecting this base range.

Filters

After mixing, either the sum or difference frequency is selected by filter FL1 or FL2. These are each five-pole elliptic designs with 40 dB attenuation of the unwanted signal. The designs are not critical and allow for normal component tol-

erances. The filter responses are shown in Figure 5 and the corresponding schematics in Figure 6.

Standard value ceramic capacitors are used. Inductors are wound on T37-2 (red) powdered iron torroids with #26 enamel wire for the low pass and #30 for the high pass. No alignment is necessary.

Amplifier and Level Control

After mixing and passing through the filters, the signal needs to be boosted in amplitude for some applications. The MC1350 circuit provides up to 40 dB of gain when used in a push-pull arrange-

Parts Availability Table

C1	25-220 pF variable, Fair Radio Sales #C9/SG-15
C2	8-20 pF trimmer, Fair Radio Sales #074-050J-2
C3	5-12 pF trimmer
C4	16 pF
C5	300 pF
C6,C10,C13,C15,C16,C17,C19,C20, C21,C22,C23,C24	0.01 μ F
C7,C8,C11	47 pF
C9	470 pF
C12	68 pF
C14	0.047 μ F
C18	0.22 μ F
C25	0.022 μ F
R1	2k resistor
R2	3.9k
R3	4.7k
R4,R5	15k
R6	1.8k
R7	2.4k
R8,R13,R15,R17,R19,R20,R25,R32,R35	1k
R9	100k
R10,R36	270 ohm
R11,R12	470 ohm
R14,R18,R26,R37	510 ohm
R16	820 ohm
R21,R29,R34	10k
R23	300 ohm
R24	100 ohm
R27	1.5k
R28	680 ohm
R30	1k potentiometer
R31	1.2k
R33	51k
R37	150 ohm
L1	5T #22 wire on 1/4" slug tuned form
T1,T2	trifilar 10T #26 wire on Fair Rite #2643002401 torroid, Amidon FT37-43 also usable
U1	Harris/RCA CA3028 RF amplifier/oscillator, Jameco, also available as ECG724
U2	Motorola MC1496 balanced mixer, Jameco
U3	Motorola MC1350 IF amplifier, Jameco, also available as NTE746 or ECG746
MPF102	Radio Shack 276-2062
2N2222	Radio Shack 276-1617
S1	2-pole, 6-position rotary switch, Radio Shack
S2	4-pole, 3-position rotary switch, Radio Shack
knobs	Caltronics Filter inductor (all wound on Amidon T37-2 torroid cores):
3 uH	27T #26
4.6 uH	34T #26
5 uH	36T #30
7.6 uH	44T #30 Fixed frequency tank circuits:
3 MHz	70T #33 on 9/32" form with 100 pF capacitor
6 MHz	27T #30 on 9/32" form with 100 pF
9 MHz	21T #26 on 1/4" form with 100 pF
12 MHz	18T #26 on 7/32" form with 100pF
15 MHz	11T #26 on 7/32" form with 100 pF

BATTERIES

Nickel-Cadmium, Alkaline, Lithium, Sealed Lead Acid For Radios, Computers, Etc. And All Portable Equipment

**YOU NEED BATTERIES?
WE'VE GOT BATTERIES!**

CALL US FOR FREE CATALOG



E.H.YOST & CO.

7344 TETIVA RD.
SAUK CITY, WI 53583
(608) 643-3194
FAX 608-643-4439

CIRCLE 114 ON READER SERVICE CARD



**HEIGHTS
TOWER SYSTEMS**



The pioneers in aluminum towers bring you higher heights and wind loads than ever before.

- Self-supporting up to 144 feet at 75 mph winds.
- Complete tapered and telescoping models.
- Easy to assemble and erect.
- Full range of manually and electrically operated Fold-Over-Kits

Heights offers you unmatched versatility, value and quality in a tower system that has been proved and improved for over 30 years.

For our new brochure giving dozens of combinations of height, weight and wind load, contact:

HEIGHTS TOWER SYSTEMS, LTD.

1721 Indian Rd. • Lapeer, MI 48446

(313) 667-1700

CIRCLE 284 ON READER SERVICE CARD
73 Amateur Radio Today • July, 1992 29

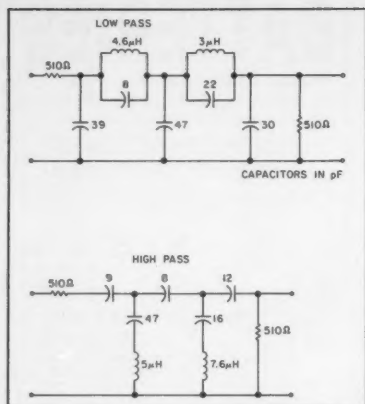


Figure 6. Filter schematics.

ment as shown. A broadband transformer using a ferrite toroid from Fair-Rite Products, terminated in a 1k ohm resistor, does a nice job over the entire high frequency spectrum.

Level control comes from adjusting the AGC input voltage between 5 and 9 volts with a 1k ohm front panel potentiometer. Maximum gain occurs at 5 volts with an over-60-dB drop in signal at 9 volts. A cathode follower circuit then isolates the

amplifier and drives the output BNC jack with over 200 mV at a 270 ohm source impedance.

Power

I recommend a regulated 12-volt supply for this generator. I installed an RCA phono jack on the rear panel and use an external bench supply. There is ample room, however, inside the home-brew 6" x 7" x 6" box to accommodate a battery- or line-operated supply if you want to build one in.

Construction Details

The overall schematic is shown in Figure 7. Plastic pulleys are easily turned with an electric drill and file (see J. Pivnichny, "A Homebrew Tuning Dial," *Ham Radio*, December 1988, p.75). The small brass pulleys are made from 1/4" brass spacers, also using the electric drill and file for turning. I included a small APC trimmer capacitor as a fine-tuning control. This is ideal for tuning through the skirts of crystal filters. One of the nice things about home-brew gear is that you can include features like this if you do crystal filter experimenting.

The 7" x 6" front panel has a 1" x 2" window cut out and backed with a 1-1/2" x 3" x 1/8" sheet of clear plastic. A verti-

cal line is scribed on the plastic and filled with black magic marker to serve as the cursor. White dry transfer letters are used on a dark gray paint. Additional lines are put on using a drawing pen and white drawing ink. A final lacquer spray before mounting the controls protects the lettering.

All components except the panel controls and tank circuits are mounted on the foil side of a 3" x 5" piece of single-sided epoxy glass circuit board. The foil serves as a ground plane. Component leads pass through counter-sunk holes and are interconnected on the back side. See the photographs for placement of the circuit boards inside the box.

Final Words

I've used the generator along with my sensitive RF voltmeter (see J. Pivnichny, "A Sensitive RF Voltmeter," *Ham Radio*, July 1989, p. 62) for lots of measurements around the shack. Most measurements can be made with the signal provided at the BNC jack. For very sensitive work, remember that unwanted signals (although 40 or more dB down) are still present so additional external filtering may be desirable.

Good luck with building your own laboratory-style signal generator.

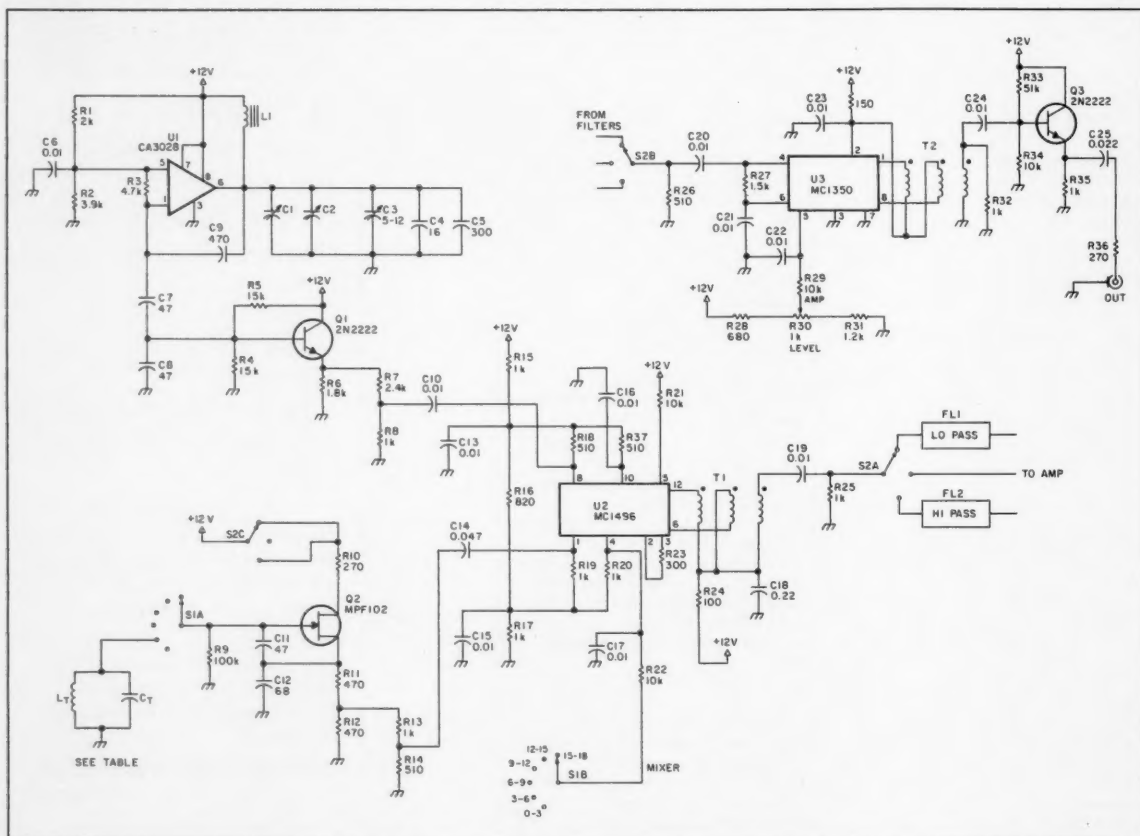


Figure 7. Overall schematic of signal generator.

IMPROVE YOUR
LOOKS, HEALTH
AND POPULARITY.



American Heart
Association

© 1992, American Heart Association



ICOM

Let's Talk Radio
7 days a week
6 pm to 12 pm
Spacenet-3
Transponder 21
6.2 Audio

**VHF
COMMUNICATIONS**

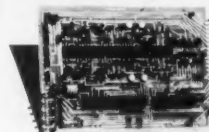
280 Tiffany Avenue
Jamestown, New York 14701

Let's Talk Radio's friend... another radio dealer!
PH. (716) 664-6345
(800) 752-8813 for orders only

9:00 am - 5:30 pm
weekdays
Weekends and evenings
by appointment.

CIRCLE 14 ON READER SERVICE CARD

THE MULTIPLE RECEIVER SOLUTION



4 Channel Signal-to-Noise Voter

- Expandable to 32 Channel by Just Adding Cards
- Continuous Voting
- LED Indicators of COR and Voted Signals
- Built-in Calibrator
- Remote Voted Indicators Pinned Out
- 4 1/2 x 6 Double Sided Gold Plated 44 Pin Card
- Remote Disable Inputs
- MORE

Built, tested and calibrated with manual

\$370.00

Rack mount version also available

For more information call or write:

DOUG HALL ELECTRONICS

Voter Department

815 E. Hudson Street, Columbus, Ohio 43211

(614) 261-8871

FAX (614) 261-8805

CIRCLE 19 ON READER SERVICE CARD

Contact Advertisers Easily
Use Your
Reader Service Card

Michigan Radio

SALES

SERVICE

23040 Schoenherr, Warren, MI 48089
OPEN MON-FRI 10-6, SAT 10-4, SUN CLOSED

ORDERS
IN-STATE
SERVICE
FAX SERVICE

1-800-TRU-HAMM
1-313-771-4711
1-313-771-4712
1-313-771-6546

WANTED: QUALITY USED GEAR, CASH OR TRADE

KENWOOD

HT'S MODEL	DESCRIPTION	LIST	CURR
TH-225A	2M 5W SCANNING DEL	389.95	CALL
TH-27A	2M 2.5W MICRO 40ME	419.95	CALL
TH-47A	70CM 2.5W MICRO	429.95	CALL
TH-41E	70CM 2W SCANNING DEL	419.95	CALL
TH-77A	2M/70CM DEL DUAL B	599.95	CALL

MOBILE VHF/UHF MODEL	DESCRIPTION	LIST	CURR
TM-241A	2M 45W PROG MIC	489.95	CALL
TM-331A	220MHz 25W PROG MIC	489.95	CALL
TM-441A	440MHz 25W PROG MIC	479.95	CALL
TM-631A	2M/220MHz DUAL BAND	749.95	LMTD CALL
TM-791A	2M/70CM/2 TRIBANDER	849.95	CALL
TM-741A	2M/70CM/2 TRIBANDER	849.95	CALL
TM-941	2M/440MHz 1.2 TRI-BAN	1199.95	CALL
TM-751A	2M 25W ALL-MODE	899.95	CALL
TS-711A	2M 25W ALL-MODE BASE	1099.95	CALL
TS-700A	2M/70CM SATELLITE	1999.95	CALL

HF EQUIPMENT MODEL	DESCRIPTION	LIST	CURR
TS-140S	HF COMP GEN COV	949.95	CALL
TS-800S	HF80M COMP GEN COV	1549.95	CALL
TS-450S	HF DELUXE COMP	1349.95	CALL
TS-450S/AT	HFDEL COMP TUNR	1549.95	CALL
TS-850S	HF 12V DEL DDS	1899.95	CALL
TS-850AT	HF 12V DEL TUNR	1899.95	CALL
TS-850S	HF BASIC VERSION	2399.95	CALL
TS-850SD	HF THE DX MACHINE!	4399.95	CALL

WE STOCK A FULL LINE OF ACCESSORIES
FOR THE KENWOOD LINES. CALL FOR OUR DISCOUNTED PRICES!
1-800-TRU-HAMM

TERMS:
Prices Do Not Include Shipping.
Price and Availability Subject to
Change Without Notice
Most Orders Shipped The Same Day
COD's Welcome (\$4.00 + shipping)

ICOM

HT'S MODEL	DESCRIPTION	LIST	CURR
IC-20AT	2M 5W 10MEM DTMF	409.00	CALL
IC-20AT	2M 7W 15MEM DTMF	429.00	CALL
IC-25AT	2M 2.5W DEL. MICRO	439.00	CALL
IC-2SRA	2M/SCANNER HT	599.00	CALL
IC-24AT	2M/70CM DEL MICRO	499.95	CALL
IC-25AT	220M 2.5W MICRO	449.00	CALL
IC-4SAT	70CM 2.5W MICRO	449.00	CALL
IC-4SRA	70CM/SCANNER HT	599.00	CALL
IC-4SAT	70CM 7W 15MEM DTMF	449.00	CALL
IC-4SRA	2M/70CM DUAL. MICRO	629.00	CALL

MOBILE VHF/UHF MODEL	DESCRIPTION	LIST	CURR
IC-220A	2M FM, 25W 20MEM	449.00	CALL
IC-220V	2M FM, 45W 20MEM	479.00	CALL
IC-3220A	2M/70CM 25W 40MEM	699.00	CALL
IC-3220H	2M/70CM 45W 40MEM	699.00	CALL
IC-2410	2M/70CM 45W DEL.	TBA	CALL

HF EQUIPMENT MODEL	DESCRIPTION	LIST	CURR
IC-72S	HF COMPACT GEN COV	949.00	CALL
IC-72S	HF80M COMP GEN COV	1299.00	CALL
IC-73S	HF DELUXE COMPACT	1149.00	CALL
IC-751A	HF 12V BASE TXCR	1899.00	CALL
IC-75S	HF DELUXE TNRPS	3149.00	CALL
IC-751	HF DXERS DELIGHT!	6149.00	CALL

WE STOCK A FULL LINE OF ACCESSORIES
FOR THE ICOM LINES. CALL FOR OUR DISCOUNTED PRICES!
1-800-TRU-HAMM

YAesu

HT'S MODEL	DESCRIPTION	LIST	CURR
FT-411E	2M 2.5W 50MEM, CTCSS	405.00	CALL
FT-811	70CM 2.5W 50MEM	405.00	CALL
FT-470	2M/70CM 2.5W 50MEM	491.00	CALL
FT-26	2M 5W WITH DTMF PAGING	349.00	CALL
FT-76	440MHz 5W WITH DTMF PAGING	389.00	CALL

MOBILE VHF/UHF MODEL	DESCRIPTION	LIST	CURR
FT-290R1	2M 25W ALL-MODE	810.00	CALL
FT-800R1	8M 10W ALL-MODE	732.00	CALL
FT-726R	2M/70CM 220V/1.2 SAT	1622.00	CALL
FT-5200	2M/70CM DUAL BAND	749.00	CALL
FT-8200	70CM/1.2 DUAL BAND	899.00	CALL
FT-5400H	2M 50W LCSS, CTCSS	419.00	CALL

HF EQUIPMENT MODEL	DESCRIPTION	LIST	CURR
FT-747GX	HF 10V/10W MOBILE	899.00	CALL
FT-757GXII	HF COMP GEN COV	1099.00	CALL
FT-767GX	HF 10V/10W TUNR	2299.00	CALL
FT-790	HF 12V DEL TUNR	2399.00	CALL
FT-1000B	HF BASIC VERSION	3399.00	CALL
FT-1000D	HF QSL CATCHER!	4399.00	CALL

WE STOCK A FULL LINE OF ACCESSORIES
FOR THE YAESU LINES. CALL FOR OUR DISCOUNTED
PRICES! 1-800-TRU-HAMM

TEN-TEC

HF EQUIPMENT—AMERICAN MADE MODEL	DESCRIPTION	LIST	CURR
CMN IV	HF 5 BAND TXCR	2245.00	CALL
PARAGON	HF GEN COV TXCR	2245.00	CALL

CIRCLE 162 ON READER SERVICE CARD

by J. Robert Witmer W3RW

32 73 Amateur Radio Today • July, 1992

STARTEK

FREQUENCY COUNTERS

SUB-COMPACT PORTABLE INSTRUMENTS FOR THE COMMUNICATIONS PROFESSIONAL, HAM OR HOBBYIST

Choose from 6 NEW MODELS
WITH ADDED FEATURES & PERFORMANCE

Our low power design yields 3 to 5 hours portable operation from the high capacity internal NI-CAD batteries. (Standard in all models).

StarCab™ top quality US made aluminum cabinets are used with machine screw assembly. No cheap extruded aluminum or steel with self-tap screws.

Convenient **POCKET SIZE**: 3.4"W, 3.8"H, 1"D.
A 2 inch RF SIGNAL BAR GRAPH, ULTRA HIGH SENSITIVITY and operation to 3.5 GHZ, all available in the **STARTEK** sub-compact models.

STANDARD FEATURES INCLUDE:

- NI-CAD BATTERIES & 110VAC ADP/CHARGER
- 1 PPM TCXO TIME BASE - FRONT PANEL ADJ
- 3 GATE TIMES • HOLD SWITCH & INDICATOR
- 9-12VDC AUTO-POLARITY POWER INPUT
- StarCab™ ALUMINUM CABINET
- COMPUTER AIDED CIRCUIT DESIGN
- TOP QUALITY COMPONENTS
- 100% ASSEMBLED IN THE USA
- 1 YEAR LIMITED WARRANTY

ORDER NOW!
SAVE UP TO
\$30
CALL FOR DETAILS

NEW BAR GRAPH SERIES

ULTRA HIGH SENSITIVITY RF DETECTOR - COUNTERS

These new models are the most sensitive counters yet. A bright LED BAR GRAPH functions as a signal strength indicator. Very useful for testing, adjusting, repairing or locating RF devices. These are simply the best portable RF counters available today!



15-BQ
1 MHZ - 1500 MHZ
ULTRA HIGH SENSITIVITY
2 INCH BAR GRAPH
\$220



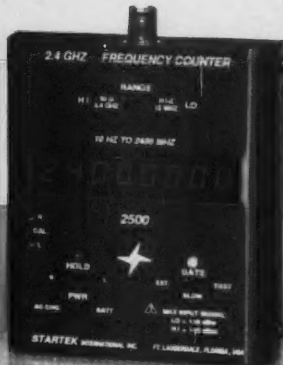
35-BQ
1 MHZ - 3200 MHZ
ULTRA HIGH SENSITIVITY
2 INCH BAR GRAPH
\$265



1350
1 MHZ - 1300 MHZ
QUALITY & ECONOMY
(REPLACES #1500A)
\$129



15-UHS
1 MHZ - 1500 MHZ
ULTRA HIGH SENSITIVITY
(REPLACES #1500HS)
\$169



2500
10 HZ - 2400 MHZ
HI-Z INPUT - LO RANGE
HIGH SENSITIVITY
\$210



3500
10 HZ - 3500 MHZ
HI-Z INPUT - LO RANGE
HIGH SENSITIVITY
\$250

ACCESSORIES:

#CC-90	BLACK VINYL ZIPPER CASE	\$12.00
#TA-90	TELESCOPING BNC ANT	12.00
#P-110	PROBE, 200 MHZ, 1X-10X	39.00
#M207IC	CABLE FOR MFJ-207/208	10.00

**ALL MODELS
IN STOCK
WE SHIP
SAME DAY!**

ORDER FACTORY DIRECT

Orders & Information
305-561-2211

Orders only
800-638-8050
FAX 305-561-9133



STARTEK INTERNATIONAL INC

398 NE 38th St., Ft. Lauderdale, FL 33334

TERMS: Shipping-handling charges for Florida add \$4 + tax, US & Canada add 5% (\$4 min - \$10 max), others add 15% of total. COD fee \$4. VISA, MC or DISCOVER accepted. Prices & specifications subject to change without notice or obligation.

CIRCLE 247 ON READER SERVICE CARD

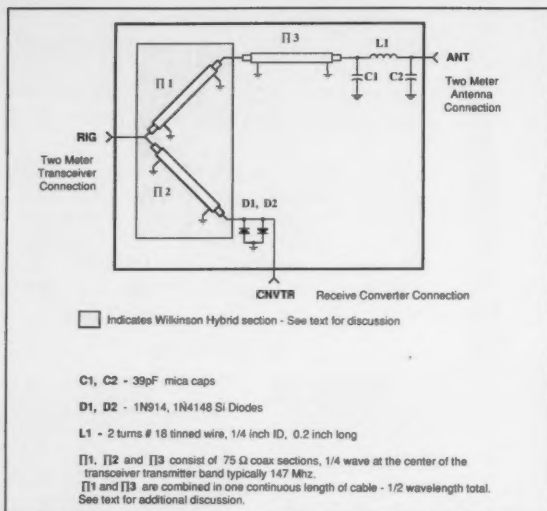


Figure 2. Schematic diagram of the Receive Converter Adapter as used with a 2 meter transceiver.

current—there is some interaction between these adjustments. Between the output of the oscillator (Q1 and Q2) and the MMIC (U2) is a low-pass filter consisting of L4, C16 and C17.

The mixer is a Mini-Circuits Labs SBL-1 DBM or equivalent. With the 90 MHz LO, 6 meter signals from 52 to 54 MHz are translated to 142 MHz to 144 MHz, which provides for ease of readout.

220 MHz converter adapter operation: Two 220 MHz converter configurations are shown in Figures 5 and 6. The converter in Figure 5 translates 223-225 MHz to 146-148 MHz which results in some interference between on-the-air 2 meter signals and the translated 220 signals, an example to possibly avoid depending on the activity in your area.

I've also used a 220 converter similar to the 6 meter converter just described (see Figure 6) except it used an 80 MHz LO. With an 80 MHz LO, signals from 223 to 225 MHz are translated to 143 MHz to 145 MHz, which again provides for simplified frequency translation.

Construction

My converter adapter was constructed in a small aluminum chassis using a mixture of UHF and BNC

connectors to match the cables I had. RG-59/U 75 ohm coax was used. Be careful that diodes D1 and D2 are soldered directly across the converter connector (CNVTR) with minimum lead length. If the diodes are accidentally placed across either of the other connectors, a high SWR will be presented to your rig on transmit. Installation of the diodes is best done after the coax sections are soldered to minimize excess heating. An ohmmeter check of the coax sections after installation is a good idea to make sure no inadvertent shorts were created during soldering. A two-lug terminal strip was soldered to the base of the antenna port connector SO-239 and supports the input (coax) end of L1 and C1. The output side of L1 connects directly to the center conductor of the antenna port connector to which C2 is soldered.

Trim the coax to approximately the length needed—remember to include the velocity factor of the coax. For RG-59/U this is usually 0.66, which means a quarter-wavelength of cable at 147 MHz should be approximately $[(246/147) \times 0.66]$ feet long, which comes to approximately 1.1 feet, using the formulas from Chapter 16 of the *ARRL Handbook*. The half-wave section is simply twice this

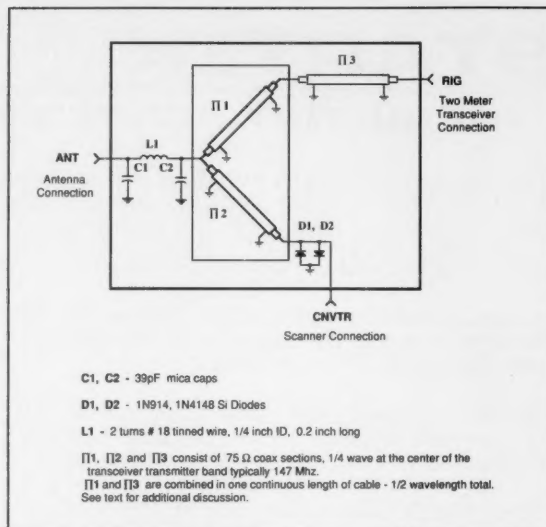


Figure 3. Using the Receive Converter Adapter with a scanner.

long. (If you are going to use the grid dip oscillator (GDO) technique for fine tuning the sections, cut them a little long to begin with.)

Oscillator Construction: The local oscillators for the 6 meter and 220 MHz converters were constructed using a technique I've used for several years for RF circuits. Using a 2-1/4" by 3-3/4" piece of double-sided G-10 circuit board material as the base, I glued small pieces of single-sided board material, cut to the size required for the particular pads, to the main board. Feedthrough bypass capacitors are used where possible for bypass requirements. With this approach, the DC power distribution is done on the opposite side of the circuit board from the RF components. Grounding is accomplished by soldering directly to the ground plane—keeping the RF circuit ground leads as short as possible. If a change is required you can pry the desired pad loose and glue it in the new location. Figures 8A and 8B show the approximate part layouts of my 90 MHz local oscillator. Try to use small components when possible; it will simplify construction and minimize problems associated with layout. L1 and L2 must be mounted perpendicular to each other. L1 is mounted horizon-

Continued on page 59

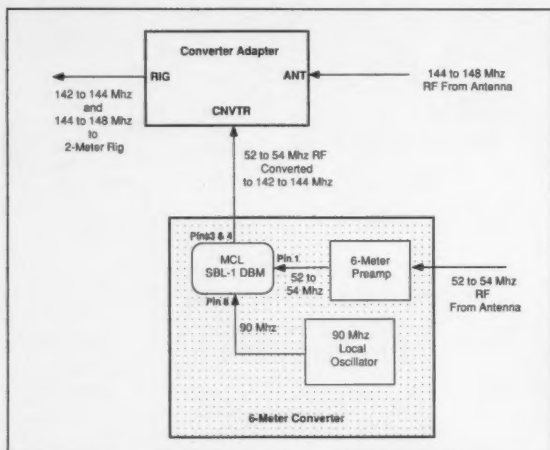


Figure 4. Six meter converter for the Converter Adapter.

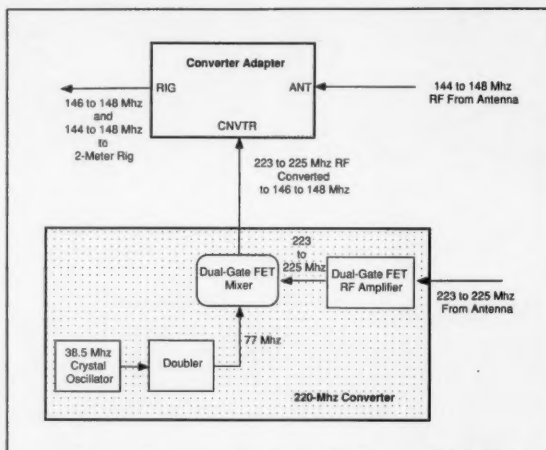


Figure 5. Converter circuit for 220 MHz operation.



So compact, so sophisticated.

AVAILABLE NOW!
FANTASTIC 2-METER H.T.'s
HIGH PERFORMANCE AT A GREAT PRICE

- DJ-F1TH World's smallest 5 watt H.T.
- DJ-162TR Full featured 2-meter comes standard with EDC-34 rapid charger

New Model DJ-580T

RATED # 1 IN JAPAN, NOW AVAILABLE IN THE U.S.

A super-compact handheld, the tiny DJ-580T is a powerful, feature-packed twin bander. This super-compact HT is the smallest you'll find, and literally fits in the palm of your hand.

Ergonomic design, combined with excellent sensitivity and unbelievable great sound, sets a new standard for miniature HT's.

New MCF function allows you to set the 40 memory channels regardless of which channels you want for VHF or UHF. Any combination is possible.

Alinco's DJ-580T has Full-Duplex Cross Band Operation and Cross Band Repeater Functions with real world power and excellent sensitivity. Airband

receive with simple modification.

If the battery is depleted to less than 5 volts, Alinco's Patented Super Low Battery Consumption Function is automatically activated. You can continue to operate the radio all the way down to 3.5 volts. This feature is effective with dry cell batteries only.

This unit has built in DSQ for paging, CTCSS encode and decode standard, various scanning functions, 3 power level selections for each band, bell function, and an illuminated keypad.

Check out the affordable technology of the 90's. Check out ALINCO.



ALINCO
ELECTRONICS INC.

ALINCO ELECTRONICS INC.
438 Amapola Avenue, Unit 130, Torrance, CA 90501
Tel. (310) 618-8616 Fax (310) 618-8758

Two Year Limited Warranty.
Specifications and features are subject to change without notice or obligation.
CIRCLE 67 ON READER SERVICE CARD

The MFJ-9020

20 Meter CW Transceiver

and Integrated CW Station

A versatile and portable QRP combo.

Mention MFJ and visions of antenna tuners and ham accessories pop into your head. Until recently, QRP rigs weren't in the line-up. The MFJ-9020 will alter your thinking from now on.

The MFJ-9020 is a 20 meter QRP (low-power) transceiver designed by Rick Littlefield K1BQT. It covers 14.000 to 14.075 MHz of the 20 meter CW band. The MFJ-9020 is a CW-only transceiver; it will not transmit SSB nor receive SSB.

First Impressions

After opening the box, what really impressed me was the "feel" of the rig. It's constructed of 1/16-inch aluminum throughout. The speaker is top-mounted. There are but three controls on the front panel: volume, VFO tuning and RIT. Two LEDs give the operator visual verification of power on and off as well as transmit.

The back panel sports the usual power connections, which fit a 5.5mm o.d. coaxial plug. The center pin is positive. For keying the radio, you have two choices. First, you may plug in a straight key, output from a keyer or even an old bug in the key jack. The key jack requires a 3.5mm mono plug. Or, you may install the optional keyer and then use the keyer's jack, which requires a 3.5mm stereo plug.

There's an additional switch for the optional CW audio filter. In the review unit, both the keyer and the audio filter are in place. Both the switch to select the audio filter and the keyer speed are mounted on the back panel.

A real surprise for a QRP transceiver is finding an SO-239 antenna connector instead of the common RCA jack many QRP builders use for RF connections.

Of course I had to open the case for a look inside. I'm impressed! The entire transceiver is built on one double-sided board with plated-through holes. There are but three wires in the entire radio: two wires for the speaker and one from the PC board to the antenna connector. Everything else is mounted on the PC board. And I mean *everything* is mounted on the PC board, including all the pots, LEDs and all the



Photo A. The MFJ-9020 20 meter CW transceiver.



Photo B. The MFJ integrated CW station includes the transceiver, a portable antenna tuner, a portable power pack and a 20 meter folded dipole.

input/output jacks. Not only does this make for a very reliable unit, but it also reduces labor cost during construction. The PA transistor, an MRF 476, is bolted to the side of the chassis. The MFJ-9020 easily passed the number five crane test. That's a drop of three feet onto a solid surface.

The PC board is well labeled with all the adjustment pots clearly marked as to what they do. All the ICs are in sockets for easy replacement if and when replacement is needed. If you've ever worked on a double-sided board with plated holes, you'll instantly know the advantages of IC sockets. There are no "Do Not Touch" areas on the board. The circuit is simple and well thought out.

The Manual

A very detailed manual comes with the MFJ-9020. They even include all the Radio Shack stock numbers for the required plugs used for power and keyer. By the way, don't use molded adapters as they may damage the input/output sockets on the PC board.

Both a block diagram and full schematic have been included. This is a real nice touch for repairing the MFJ-9020 should the need arrive. If nothing else, it's nice to read how it works and why.

There are many tips for setting up the MFJ-9020 and getting it on the air. Included in the manual are several examples of simple 20 meter antennas. Several pages of field alignment procedures, as well as some general troubleshooting, may also be found in the manual.

The Insides

The MFJ-9020 is sensitive. A side-by-side comparison between my Argosy II and the MFJ-9020 showed very little difference between the two. If I could hear a station on the Argosy II, I could hear it on the MFJ-9020. The receiver is a superhet—NOT A DIRECT CONVERSION RECEIVER! You get single-signal reception with the MFJ-9020, thanks in part to the 8-pole crystal filter. The crystal filter is about 750 Hz at -6 dB. With the optional audio CW filter, you have some very powerful QRM-fighting tools.

Receiver signals are preselected by a 4-pole bandpass filter before the signal is routed to the NE602 receiver mixer. A 78L05 keeps the VCC regulated at 5 volts to ensure a voltage-stable VFO. A varactor RIT circuit provides VFO shift on receive only. A MC1350 IF amplifier is coupled to a second NE602 used as a product detector. This comprises the IF stage. Audio from the product detector goes to an LM386. The LM386 operates at full-loop gain and the volume level is set by an adjustable attenuator. Receiver AGC is provided by the LM386. AGC delay seems to be just about right for CW use.

On the transmit side, a third NE602 mixer

ID-7400 AUTOMATIC VOICE IDENTIFIER



The ID-7400 is an automatic voice identifier for use on any transceiver or repeater. The ID-7400 records your voice ID, then automatically transmits it at the proper time, on the release of your PTT switch. Two switch selectable IDs can be recorded and stored in non volatile electronic memory. Records from the station microphone. Installs between the microphone and the transceiver. No soldering required. Uses 8 pin mic connectors.



**INTERCONNECT
SPECIALISTS INC.**

1215 N. CR427, SUITE 105
LONGWOOD, FL 32750
TOLL FREE 800-633-3750

CIRCLE 100 ON READER SERVICE CARD

STANDARD AMATEUR RADIOS

Now available - The worlds finest amateur radios. Unsurpassed quality and features make STANDARD the worlds most popular line of amateur radios.

Mini Deluxe HTs:

C168A 2 meter

Call For
Price

C468A 450MHz

Twin Band HTs

C228A 2M/220MHz

Call For
Price

C528A 2M/440MHz

C628A 440MHz & 1.2GHz

Twin Band Mobile

C5608DA 2M/440MHz

Call For Price

We also have many accessories for these radios and most heath radios.

Call 1-800-292-7711 for details.



C & S SALES, INC. • 1245 Rosewood, Deerfield, IL 60015

(708) 541-3800 • FAX: 708-520-0085

WE WILL NOT BE UNDERSOLD

WRITE FOR FREE CATALOG
PRICES SUBJECT TO CHANGE

CIRCLE 184 ON READER SERVICE CARD

BATTERIES

You've bought our replacement batteries before...
NOW YOU CAN BUY DIRECT FROM US, THE MANUFACTURER!

BUYER BEWARE!!!!

Some replacement battery manufacturers misrepresent their products.

- Example: W & W Associates replacement for a YAESU battery is 7.2v @ 1000MAH in the same size case as YAESU'S FNB-12(S). We call it a 10(S). Other manufacturers claim they have a 10(S), but theirs is only 7.2 v @ 750MAH, in the same size case as ours.
- Some manufacturers state they have high capacity batteries but they neglect to tell you that their case size is considerably LONGER than the original case size (DON'T BE SURPRISED, THE ABOVE SHOULD BE STATED).
- DON'T HESITATE to ask the AFTERMARKET BATTERY MANUFACTURER to state which cells they are using. Example: We are now using a SANYO KR1100AAE Nicad in our 10(S) packs.

BUYER BEWARE!!!!

FOR THE MONTH

**NEW OF JULY
10 % OFF**

**Replacement Batteries
for YAESU**

FNB-25 7.2v @ 600MAH

FNB-26 7.2v @ 1000MAH

***FNB-26A 9.6v @ 800MAH**

FNB-27 12v @ 600MAH

****FNB-27S 12v @ 800MAH**

*same size as FNB-26

** 1/4 inch longer than FNB-27

LOOK FOR AUGUST SPECIAL OF THE
MONTH

Monthly discounts applicable to End-
Users ONLY.



Discover now accepted
NYS residents add
8 1/4% sales tax.
Add \$3.50 for postage
and handling.



Prices and specifications subject to change without notice.

**SOURCE FOR ALL YOUR COMMUNICATION
BATTERY REPLACEMENT NEEDS.**

W & W ASSOCIATES

29-11 Parsons Boulevard, Flushing, N.Y. 11354

WORLD WIDE DISTRIBUTORSHIPS AVAILABLE. PLEASE INQUIRE.

In U.S. & Canada Call Toll Free (800) 221-0732 • IN NYS (718) 961-2103 • Telex: 51060 16795 • FAX: (718) 461-1978

MADE IN
THE U.S.A.
SEND FOR
FREE CATALOG
AND PRICE LIST

CIRCLE 191 ON READER SERVICE CARD

couples signal from the VFO with its 10 MHz transmit oscillator to produce 14 MHz CW. After two stages of amplifiers/buffers, the resulting signal is applied to the PA transistor. The MRF 476 produces 5 watts at 13.8 volts, consuming 1.2 amps of current.

Keying is semi-QSK with an antenna relay. There is an automatic 700 Hz transmit offset, just like the big rigs. During transmit, a sidetone is injected into the audio line.

Performance

Enough of this techno talk. How well does the MFJ-9020 work? In a word, great!

With only three controls to worry about, putting the MFJ-9020 on the air is about as simple as you can make it. You'll need a power supply running 13.8 volts at one amp or better. Any power source of one amp or so at 13.8 volts will work. A battery will work fine, but we'll talk more about battery operation later.

There is no reverse polarity protection built into the MFJ-9020. If you hook it up backwards, you'll be sending it back to the factory. Although the pin-out of the coaxial plug is shown in the manual, it's not silk-screened on the back of the radio. I can see in the heat of a contest someone hooking the MFJ-9020 up backwards. In the next run, MFJ will add a zener diode and fuse for full over-voltage and polarity protection. A new silk-screen will be cut for the back panel showing the pin out for the power jack.

With a 13.8 volt supply into a 50 ohm dummy load, the MFJ-9020 produces 5 watts right on the money. Current from the supply was 1.02 amps. Running the transceiver from a fully-charged battery (12.6 volts) produced 2.7 watts. As you can see, operation from a battery will produce a significant drop in RF output power. Keep this in mind for Field Day. However, at the 13.8-volt supply, the MFJ-9020 barely falls under the power level of the QRP ARCI. It's a QRO QRP rig! You may reduce power levels down to under a watt by adjusting the VFO trimpot. You can reduce the power right down to zero output if you wish.

I operate by the hunt-and-pounce method. Listening for CQs, I call the other stations. The tuning is very smooth and I was surprised to find how well the VFO tracked from one end of the dial to the other. It's not an IC-781, but dial calibration is a hundred times better than any HW-8 I've ever seen. I simply center the desired signal in the bandpass of the receiver and call. I use the RIT feature to fine-tune the signal into the bandpass when I turn on the audio filter. The RIT is very smooth from one end of its range to the other. You have about 1.5 kHz worth of RIT at your control. But, there is one drawback with the RIT: You can't shut it off. It would be nice to have a way to shut the RIT off or a center detent pot to allow you to center the RIT control. I talked with Rick Littlefield K1BQT about this, and he told me that MFJ will put in a center detent RIT control as soon as they can source the part.

The semi-QSK keying works without flaw. The antenna relay is a bit loud, but won't break any windows. The sidetone is a very pleasant sine wave instead of the usual QRP

square wave noise makers.

I used both the internal Curtis keyer and my old Ten-Tec KR5 keyer. The internal keyer is nice, but if I had to choose between the filter and the keyer, the keyer would have to go in favor of the filter.

I found that the receiver's audio level was low. Although the LM386 is rated at only 600 mW, the MFJ-9020 produces barely enough audio to fill a very tiny, very quiet room. The receiver generates very little internal noise, so it sounded as though the rig was dead when I first powered it up. Even with headphones, the audio gain control must be run fully into the stops. Since you can't adjust the sidetone level, I had to turn the volume control down when transmitting to prevent the sidetone from killing my ears. [Ed. Note: All current production units have been changed to greatly improve the audio output as described below.]

This time Rick Littlefield came through with a suggestion and a fix. Low audio is due to gain reduction caused by lowering the output of the LM317 from 12 to 10.5 volts to accommodate battery operation. Rick says he's working on a modification to run the LM386 from an unregulated Vcc. MFJ will include the modification on the next production run and they will also supply information to those who already purchased the MFJ-9020. As a fix, I simply adjusted the regulator up to 12 volts. It seems that if I set it higher, the sidetone would begin to distort. That extra several volts made a marked improvement in audio output.

With 5 watts, I felt like king of the hill. If I could hear 'em I could work 'em. I worked many stateside contacts, as well as a dozen or so DX stations.

The keying is very good and there are no signs of clicks, chirps or buzzes on the signal. The keying sounds "big rig" instead of the sometimes classic "QRP whoop de woop."

The Complete Portable Station

There are three more accessories that make the 9020 a fully portable setup.

The 4114 power supply/charger, the 971 antenna tuner and a 20 meter folded dipole is available.

I used the model 4114 portable rechargeable power pack during this review. This is a self-contained power system for the MFJ-9020. A large wall transformer supplies AC to the 4114. Inside a simple 7812 regulator circuit provides 13.8 volts at 1.2 amps. An LM317 is configured as a constant current source set at 100 mA for charging 12 D-size NiCd batteries. As with everything else in life, batteries are not included.

I'm not much of a D-size NiCd fan. Most of the 1200 mA D-size NiCds are nothing more than C cells on steroids. The C cells are rated at 1200 mA also. If you wanted to spend the extra money, then the high capacity NiCds would be a better way to go. Personally, I would swap out the NiCds in favor of two 6-volt 4 amp/hour gel/cells. They would easily fit inside the 4114s case. A second thought would be to use two 7.2 volt NiCd racing batteries. These would give you 1.2 amp/hours at 14.4 volts. The 4114 power pack is attractively

styled to match the MFJ-9020. Since the 4114 is fused internally, shorting the output means a trip inside. It would have been nice to see a panel-mounted fuse holder instead.

The wall transformer plugs into the back of the 4114 using a header. Since the cord is very stiff, I'm concerned that it may eventually mess up the header's pins after repeated plugging and unplugging.

You can't recharge the batteries while you operate the radio. Pressing the charge switch does light up the LED, but no charging will be performed. You could easily get confused unless you unplug the transformer from the supply.

This way, the LEDs are dark, telling you you're on battery power.

The Portable Tuner

The 971 portable antenna tuner is a mobile tuner that has been updated to include balanced line and random wire antennas. Most importantly, the cross-needle SWR/power meter has QRP sensitivity. The meters will display 6 watts forward and 0.2 watts reverse. No "zero" or "sensitivity" adjustment is required with cross-needle SWR displays. The meter may be illuminated if desired.

There are three different power ranges. On the high end, 300 watts forward, 60 watts reflected; middle range, 30 watts forward and 6 watts reflected; QRP range, from 6 watts forward to 1.2 watts reflected. You have a choice of any two at a time. You can switch out one range from a rear-mounted switch. Normally, these are the 300-watt and 30-watt positions. By changing two jumpers on the main circuit board in the 971, you can select whether you want the 300-watt scale or the 6-watt scale. From the factory, the normal setting is 300 watts. I think this is rather odd, seeing the tuner is a match for the 9020.

The tuner works. There's nothing fancy inside but all of the components are heavy-duty. I was able to tune out the reactance of my triband beam quite easily with the 971.

Using the MFJ 20 meter folded dipole with the tuner was very easy. In fact, the folded dipole came out with a rather low SWR to begin with. I do wish the 971 tuner had a bypass position to remove the tuner from the line.

Since the 4114 power supply and the 971 tuner are both styled to match the MFJ-9020, the trio is an attractive QRP setup.

If you're one to go in the woods to operate, you can quickly set up a portable station with the MFJ QRP combo along with the MFJ folded dipole. If you're sitting at home, then the 9020 will be happy running off of your big rig's power supply.

Even though the MFJ-9020 is a simple radio using basic off-the-shelf parts, it is capable of worldwide communications thanks to its good basic design. It is so easy to operate that a beginner can make contacts as soon as the box is opened and power applied. The "have-done-it-all" ham will have a ball with this radio. The MFJ-9020 puts back into ham radio something long ago lost—FUN! The MFJ-9020 may be the best value going in a ready-to-play ham transceiver.



HF Equipment Regular SALE
IC-781 Xcvr/ps/tuner/scope ● \$6395.00 4899



IC-765 Xcvr/ps/keyer/tuner ● \$2800.00 2239



- IC-751A** 9-band xcvr/SW rx ● \$1440.00 1159
PS-35 Internal power supply 228.00 209⁹⁵
FL-63A 250 Hz CW filter (1st IF) 59.00
FL-52A 500 Hz CW filter (2nd IF) 115.00 109⁹⁵
FL-53A 250 Hz CW filter (2nd IF) 115.00 109⁹⁵
FL-70 2.8 kHz wide SSB filter 59.00
IC-735 HF xcvr/SW rx/rv/mic ● \$1064.00 859⁹⁵
PS-55 External power supply 228.00 209⁹⁵
AT-150 Automatic antenna tuner 446.67 389⁹⁵
FL-32A 500 Hz CW filter 69.00
EX-243 Electronic keyer unit 64.67
UT-30 Tone encoder 18.67



- IC-725** HF xcvr/SW rx/rv/mic ● \$893.00 719⁹⁵
AH-3 Automatic antenna tuner 488.33 429⁹⁵
IC-726 10-band xcvr w/6m ● \$1283.00 1059

HF Accessories: Regular SALE

- IC-2KL** HF solid state amp w/ps ● \$2079.00 1679
IC-4KL HF 1 kw amp w/ps ● \$725.00 5599
EX-627 Automatic antenna selector 314.67 279⁹⁵
PS-15 20A external power supply 183.00 169⁹⁵
PS-30 Systems p/s w/cord, 6 pin plug 363.00 299⁹⁵
SP-3 External speaker 65.00
SP-7 Small external speaker 52.00
CR-64 High stab. ref. xtal; 751A, etc 79.00
SM-6 Desk microphone 47.93
SM-8 Desk mic; two cables, scan 89.00
AT-500 500w 9 band auto ant tuner 589.00 529⁹⁵
AH-2 8-band tuner w/mount & whip 780.00 689⁹⁵

Accessories for IC-781/765/763/726/725 • CALL



(●) Indicates
**Special Prices on
 Selected Items**
 until 8/15/92



- VHF/UHF Base Transceivers** Regular SALE
IC-275H 100w 2m FM/SSB/CW ● \$1455.00 1179
IC-475H 100w 440 FM/SSB/CW ● 1665.00 1359
IC-575A 25w 6/10m xcvr/ps ● 1455.00 1159
IC-575H 25w 100w 6/10m xcvr ● 1564.00 1289
IC-1275A 10w 1.2GHz FM/SSB/CW ● 1923.00 1559



- VHF/UHF FM Transceivers** Regular SALE
IC-229A 25w 2m FM/TTP mic ● \$392.00 319⁹⁵
IC-229H 50w 2m FM/TTP mic ● 425.00 349⁹⁵
IC-38A 25w 220 MHz FM xcvr ● 409.00 339⁹⁵
IC-449A 35w 440FM xcvr/TTP ● 473.00 389⁹⁵
IC-1201 10w 1.2GHz FM/SSB/CW ● 831.00 709⁹⁵

- Dual band FM Transceivers** Regular SALE
IC-2410A 25w 2m/440 FM/TTP mic ● \$889.00 729⁹⁵
IC-2410H 45w 2m/35w 440 FM/TTP ● 932.00 769⁹⁵
IC-3220A 25w 2m/440 FM/TTP mic ● 685.00 569⁹⁵
IC-3220H 45w 2m/ 35w 440 FM/TTP ● 727.00 589⁹⁵
IC-2500A 35w 440/10w 1.2GHz FM ● 1039.00 829⁹⁵

Multi-band FM Transceiver Regular SALE

- IC-901** 50w 2m/35w 440 FM xcvr ● \$1039.00 829⁹⁵
UX-R91A Broad band receiver unit 405.00 349⁹⁵
UX-19A 10w 10m unit 311.00 269⁹⁵
UX-59A 10w 6m unit 363.00 329⁹⁵
UX-S92A 2m SSB/CW module 623.00 549⁹⁵
UX-39A 25w 220MHz unit 363.00 329⁹⁵
UX-129A 10w 1.2GHz unit 571.00 499⁹⁵
UX-49A 440MHz module for IC-900 363.00 319⁹⁵
IC-970A 25w 2m/430MHz xcvr/ps ● 2409.00 1939
IC-970H 45w 2m/430 MHz xcvr ● 2567.00 2099
UX-R96 50-905 MHz receive unit 405.00 349⁹⁵
UX-97 1.2GHz band unit 1039.00 869⁹⁵

VHF/UHF Mobile Antenna Regular SALE

- AH-32** 2m/440 Dual Band mobile ant \$39.33
Larsen PD-K Roof mount 23.00
Larsen PD-MM Magnetic mount 28.75

VHF/UHF Repeaters Regular SALE

- RP-1520** 2m 25w repeater ● \$2319.00 1909
RP-2210 220MHz 25w repeater ● 1715.00 1409
RP-4020 440MHz 25w repeater ● 2392.00 1959
RP-4020/50W 440MHz 50w repeater ● 2599.00 2149
RP-1220 1.2GHz 10w repeater ● 2703.00 2229

We stock the entire ICOM line, but due to space limitations some items are not listed in this ad.



- Handhelds** Regular SALE
IC-P2AT NEW! 2m HT \$421.00 349⁹⁵
IC-P3AT NEW! 220MHz HT 421.00 349⁹⁵
IC-P4AT NEW! 440 MHz HT 467.00 389⁹⁵
IC-2A 1.5w 2m HT ● 199⁹⁵
IC-2AT 1.5w 2m HT/TTP 247.00 219⁹⁵
IC-02AT/High Power 2m ● 333.00 279⁹⁵
IC-03AT 2.5w 220 HT/TTP 319.00 259⁹⁵
IC-2SA 2m HT ● 345.00 279⁹⁵
IC-2SAT 2m/TTP ● 372.00 309⁹⁵
IC-2SRA 2m/25-905 rx ● 600.00 499⁹⁵
IC-24AT 2m/440MHz/TTP 492.00 409⁹⁵
IC-3SAT 220MHz HT/TTP 351.00 289⁹⁵
IC-4SAT 440MHz HT/TTP 351.00 289⁹⁵
IC-4SRA 440/25-905 rx ● 600.00 499⁹⁵
IC-26AT 2m HT/TTP ● 372.00 309⁹⁵
IC-46AT 440MHz/TTP ● 372.00 309⁹⁵
IC-12GAT 1.2GHz/TTP ● 381.00 319⁹⁵
IC-W2A 2m/440 HT ● 627.00 519⁹⁵

Aircraft band handhelds Regular SALE

- A-2** 5W PEP synth aircraft HT \$525.00 429⁹⁵
A-20 aircraft HT w/VOR ● 625.00 469⁹⁵
A-21 Navicom Plus Aircraft HT 660.00 499⁹⁵

For info/prices on HT accessories • CALL



Shortwave Receivers Regular SALE

- R-1** 100kHz-1.3GHz AM/FM pocket ● \$533.00 449⁹⁵
R-71A 100kHz-30MHz rx/rv ● 1019.00 829⁹⁵
RC-11 Infrared remote controller 71.00
FL-32A 500 Hz CW filter 69.00
FL-63A 250 Hz CW filter (1st IF) 59.00
FL-44A SSB filter (2nd IF) 178.00 169⁹⁵
EX-257 FM unit 49.00
EX-310 Voice synthesizer 59.00
CR-64 High stability oscillator xtal 79.00
R-72 30kHz-30MHz SW receiver ● 972.00



- R-100** 100kHz-1.856GHz AM/FM, 12v ● 707.00 579⁹⁵
R-7000 25MHz-2GHz receiver ● 1221.00 969⁰⁰
RC-12 Infrared remote controller 71.00
EX-310 Voice synthesizer 59.00
TV-R7000 ATV unit 139.00 129⁹⁵
SP-3 External speaker 65.00
CK-70 (EX-299) 12V DC option 13.00
R-9000 100kHz-2GHz all mode rec ● \$5677.00 4599

Large ICOM receivers include a Coupon redeemable toward the purchase of a ICOM R-1 from AES® for only \$349⁰⁰ (Limited Offer!)

Order Toll Free: 1-800-558-0411

FAX: (414) 358-3337

AMATEUR ELECTRONIC SUPPLY Inc.

5710 W. Good Hope Road; Milwaukee, WI 53223 • Phone (414) 358-0333

AES® BRANCH STORES

- | | | | |
|--|--|---|---|
| WICKLIFFE, Ohio 44092
28940 Euclid Avenue
Phone (216) 585-7388
1-800-321-3594 | ORLANDO, Fla. 32803
621 Commonwealth Ave.
Phone (407) 894-3238
1-800-327-1917 | CLEARWATER, Fla. 34625
1898 Drew Street
Phone (813) 461-4267
No Toll Free Line | LAS VEGAS, Nev. 89106
1072 N. Rancho Drive
Phone (702) 647-3114
1-800-634-6227 |
|--|--|---|---|

**Watch for Future
 AES® Branch Store
 Openings!**

An Eight-Channel A-to-D Converter for Your Computer

Sample the analog world with this easy interface.

by Mike Gray N8KDD

Judging by the letters I received regarding the article "High Speed Data Acquisition" in the August 1991 issue of 73, a lot of hams are using their personal computers to acquire climatological and seismic information, then share it via radio. Among the comments I received were requests for more input channels. I had already added a multiplexer to the old design, but quickly abandoned that idea because the thing kept getting more complicated. A few hours looking through the data books convinced me to try a whole new approach to the problem.

This latest interface connects to the printer port of any "clone" computer, desktop or portable. Only six wires connect the computer to the interface because the A-D chip transfers data to the computer in serial rather than parallel form.

The A-D converter has an 8-channel multiplexer that is controlled using only one wire from the computer. The data is transferred through another wire, which makes for a very simple circuit but complex software. I prefer it that way because software is a lot easier to modify than hardware, and it never wears out.

The interface needs a 9-volt battery to power the A-D chip and regulator. I had planned to use a line on the printer port to drive the interface, but the voltage available at the printer port varies among brands. The interface doesn't need to be powered up between samples, though, so I included a new surface-mount regulator with an integral switch that can be enabled using one line from the computer. The computer switches the interface on just before a sample, and turns it off after the data has been transferred. The battery lasts a lot longer that way. The regulator draws 1.8 mA even in the "sleep" mode, so I included a toggle switch on the front panel so you can shut the whole thing down. When the battery voltage drops to about 7 (replacement time), the LED will glow faintly in the sleep mode,

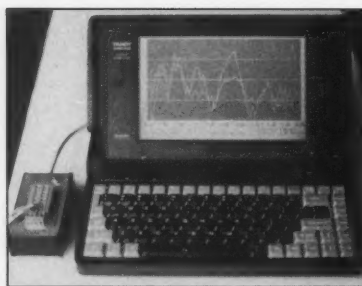


Photo A. The ADC in use.

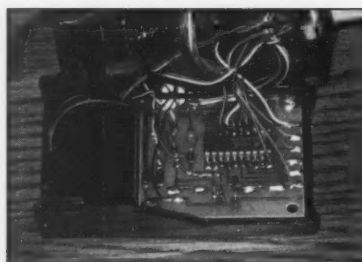


Photo B. Inside the box.

and will light up brightly while the computer takes a sample. While the battery voltage is greater than 7, the LED will remain on, whether the A-D is awake or asleep. An alkaline battery will last over 20 hours if the computer samples once per second.

ADC Operation

The A-D converter (ADC) requires some complex programming to make it work, but that's a fair trade-off for the simple hardware. The operation of the chip is described in exhaustive detail in the *National Semiconductor Linear Databook, Volume 2*. You can write your own custom programs in your favorite language, but I've found that most folks can use my M-LOG.EXE program for their purposes. Software should be easy to

use without having to refer to documentation. It should graph the data as it is collected, and store it on diskette. M-LOG.EXE has these features, and mouse support too. The program listed in the sidebar is the minimum required to make the ADC work. Everything else is frosting.

Before a conversion can be performed, the chip select (CS) line must be asserted low. Then the ADC needs a clock signal (CLK), and a bit stream on the data-in (DI) line to get set up for a sample. Once it receives the set-up stream, it performs an A-D conversion on the assigned channel.

The next eight clock signals cause the conversion result to appear on the data-out (DO) line, starting with the most significant bit (MSB).

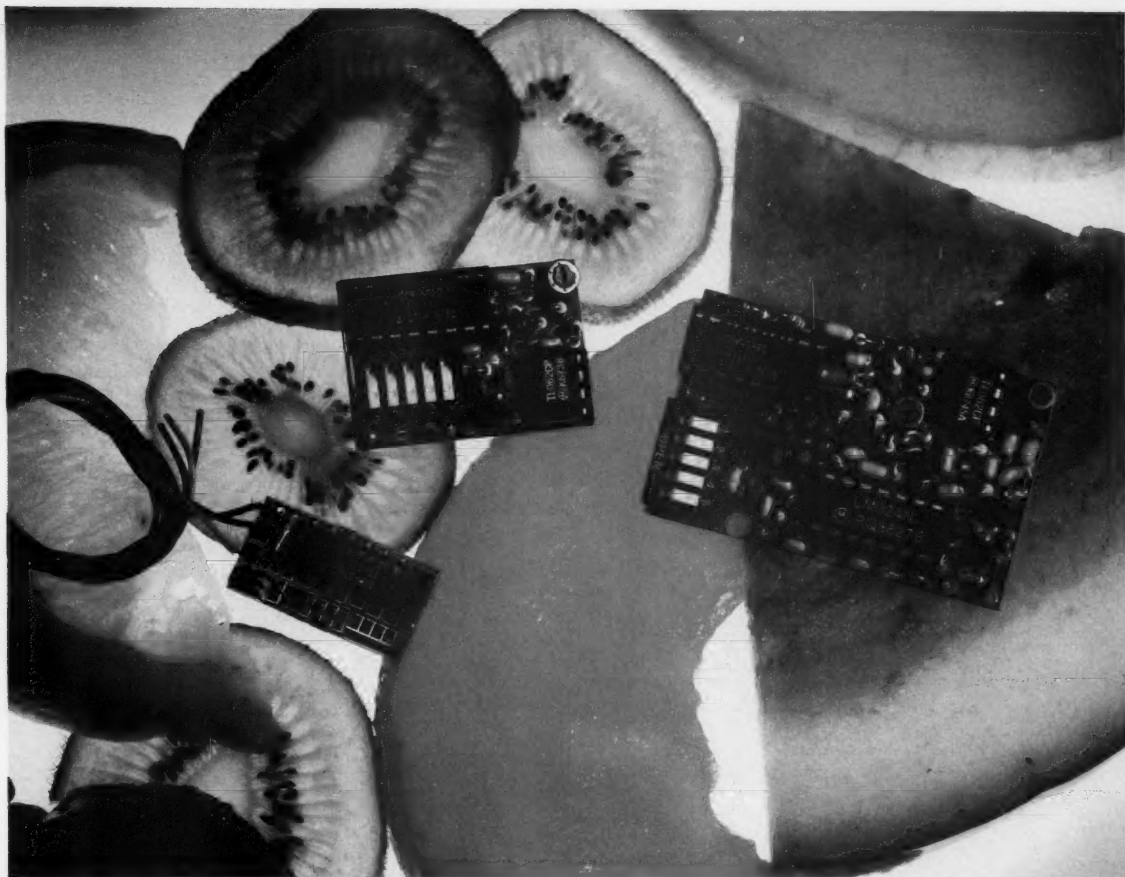
The CLK line must be asserted high before starting a conversion on the next channel.

There are three addresses assigned to the printer port. The base address is pins 2-9 and these normally transmit data to the printer. The base address of LPT1 on most computers is 888 decimal, but some are 956. LPT2 is usually 632. M-LOG.EXE allows you to select between those three possibilities. The next address at the printer port is the base address plus 1, and it is assigned to pins 10,11,12,13 and 15. These five pins are used for input only. I like to use pin 11 and tie the others to ground.

The third address at the printer port is the base address plus two. It is assigned to pins 1,14,16 and 17; these are used for output only. I use pin 1 for the CLK line.

The ADC has a high input impedance which makes it susceptible to noise. That's the reason for the 1 meg shunt resistors on the input channels.

You can leave the resistor network out if you like, but you MUST make sure you provide appropriate filtering in order to protect the ADC and get accurate data. This article barely skims the surface of the science of



Choice Selection.

Now you can have it all! Take all the qualities you've come to depend on in our programmable CTCSS tone equipment: Astonishing Accuracy; Instant Programming; Unequaled Reliability; and add full spectrum tone versatility, multi-tone capability without diodes, a reprogrammable memory... It's our new harvest of CTCSS tone equipment.

The choice is yours! If standard CTCSS EIA tones do not suit your taste, select any 32 tones of your liking from 15.0Hz to 255.0Hz. And if you change your mind, no problem; the memory can be changed in your shop with our HHP-1 programmer, or at our factory for free. Your working tone is accessed by a simple DIP switch, so there's no fussing with counters or other test equipment.

Call today toll-free and find out more about this fresh new flexibility in tone signalling, and don't forget to ask about multi-tone switching without cumbersome diode networks or binary switches.

It's all brought to market by the people who introduce the freshest ideas in tone signalling, and of course our customary same day shipping and one year warranty apply.

TS-32P CTCSS ENCODER-DECODER Based on the time proven TS-32, the industry standard for over a decade. The TS-32P gives you the added versatility of a custom, changeable memory base. A low price of \$57.95 makes it an even sweeter deal.

SS-32P ENCODER Based on the equally popular SS-32 encoder. Available for CTCSS, or audible burst tones up to 6550.0Hz. Price is \$28.95.

SS-32SMP SUB-MINIATURE ENCODER Our smallest encoder for handheld applications. Now you can satisfy that customer that needs to access multiple repeater sites with a radio that has precious little space inside. At \$27.95, the price is small too.

HHP-1 HANDHELD PROGRAMMER For programming the 32 memory locations in any of our new programmable products, including our SD-1000 Two-Tone Sequential decoder. The HHP-1 is battery operated for field use, and will program ANY 32 tones from 15.0 to 6550.0Hz in .1Hz. increments. Price is \$199.95.



COMMUNICATIONS SPECIALISTS, INC.

426 West Taft Avenue • Orange, CA 92665-4296

Local (714) 998-3021 • FAX (714) 974-3420 • **Entire U.S.A. 1-800-854-0547**

CIRCLE 10 ON READER SERVICE CARD

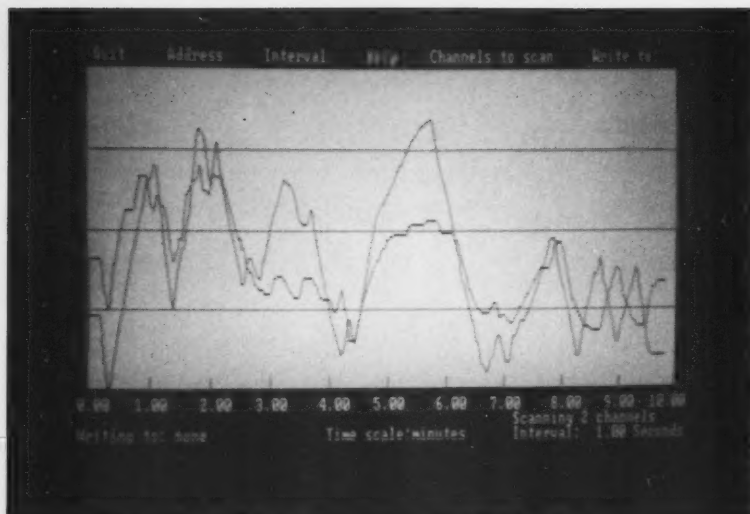


Photo C. M-LOG program running in CGA mode.

data acquisition. For more information on data aliasing, consult the *ARRL Handbook*.

Most laboratory transducers are scaled so that the output is 0 to 5 volts over their full sensing range. An input greater than 5 volts may damage the ADC, so be careful to scale all your transducers for this range. It's best

to do the voltage dividing or amplifying near the transducer if you can.

Some transducers need external excitation. For instance, if you want to measure rotary position, you could use a 25k potentiometer with 5 volts applied to it. It would be wasteful to keep a power supply running,

except during a measurement, so I included four terminal blocks which supply a regulated 5 volts when the computer wakes the ADC for a conversion. Using this 5-volt supply with resistive transducers will simplify things.

Construction

The hardware is reduced to a fairly simple form, so I chose to surface mount everything. You will have to bend the legs on the A-D chip so you can solder it to the board. The best way to do this is to push the chip onto progressively larger tubing until the legs are nearly horizontal.

Then finish the job by gently pushing it against a hard, slippery surface like a plastic-laminated counter top. If that seems too risky, bend the legs on an IC socket instead, and insert the A-D chip in the conventional manner.

Clean the circuit board by scrubbing it with a pencil eraser, to remove anything that might impede the flow of the solder. Trim one lead of a resistor and bend it so that the resistor will fit between the solder pads on the board. Tin one solder pad, then use the untrimmed lead as a "handle" and position the resistor on the solder pad. Touch a hot iron to the pad until the solder melts around the bent lead. With one end soldered tight, it will be easy to cut and bend the other lead to

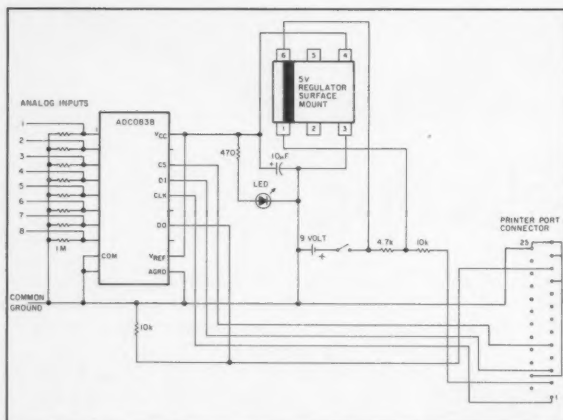


Figure 1. Schematic diagram of the A-to-D converter.

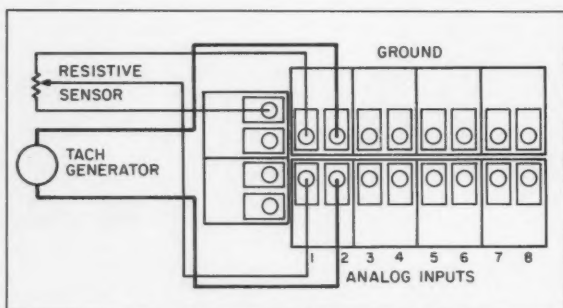


Figure 2. Typical connections for a variety of transducers.

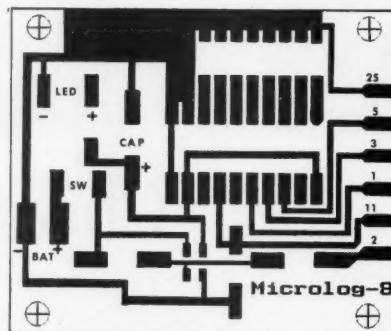


Figure 3. PC board foil pattern.

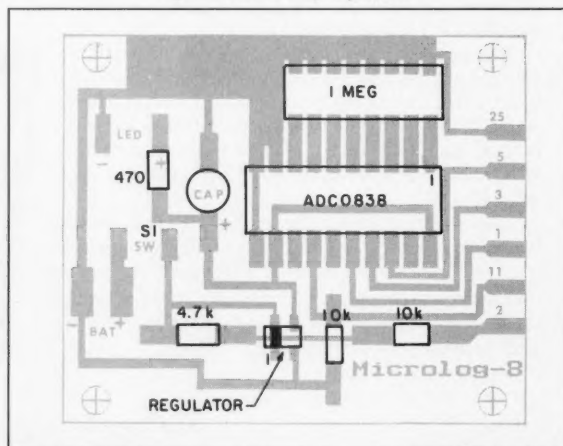


Figure 4. Parts placement. Note that all components mount on the foil side of the PC board.



THE JAPAN RADIO CO. **NRD-535**

THE NEXT GENERATION IN HIGH-PERFORMANCE HF RECEIVERS

Once again JRC breaks new ground in shortwave receiver design. The new NRD-535 has all the features SWLs and amateurs have been waiting for. General coverage from 0.1 to 30 MHz in AM, USB, LSB, CW, RTTY, FAX and Narrow FM modes. Advanced ECSS operation for phase-lock AM reception. Variable bandwidth control (BWC). Tuning accuracy to 1 Hz possible with direct digital synthesis. 200 memory channels with scan and sweep operation. Triple Superheterodyne receiving

system. Superb sensitivity, selectivity and image rejection. Dual-width noise blanker eliminates impulse noise. Squelch, RF Gain, Attenuator, AGC and Tone controls. Optional RTTY demodulator available. 24 hour clock/timer. Easy to read vacuum fluorescent display with digital S-meter. AC and DC operation. Plus the most comprehensive computer interface found on any radio to date. Call or write today for a full color brochure, price list and dealer information.



MAIN OFFICE: Akasaka Twin Tower (Main), Akasaka 2-chome, Minato-ku, Tokyo 107, JAPAN
Tel.: (03) 584-8836 Telex: 242-5420 JRCTOK J

IN U.S.A.: 430 Park Avenue (2nd Floor), New York, NY 10022
Tel.: (212) 355-1180 FAX: (212) 319-5227 Telex: 961114 JAPAN RADIO NYK

The following program causes the A-D converter to perform eight sequential conversions and display the result. It's written in Turbo BASIC/Power BASIC source code, but it will run under the GW-BASIC interpreter if you replace the delay statements with FOR/NEXT loops, and add line numbers as shown in the second listing. These programs are available on the 73 BBS under the filenames ADC Turb.BAS and ADCGW.BAS.

```

INITIALIZE: 'remarks follow the apostrophe
screen 0          'text mode 80 columns
color 14,0        'yellow on blue
cls              'clear the screen
clear            'clear all variables
toggle% = 2       'initialize variables
oddsign% = 0

MINORLOOP:
while not instat  'keep going until a key is pressed
out 888,1         'regulator line high
delay 1           'wait 1 second before next sample
out 888,0         'light up the regulator
delay .054        'wait 54 milliseconds to stabilize
for ch% = 0 to 7  'scan 8 channels
out 888,8         'CS high pin 5
out 888,2         'CS low
out 888,2         'start bit is always high DI line
out 890,0         'clock high pin 1 of DB 25 printer
for slow% = 0 to 1:next slow% 'stretches clock pulse
out 890,1         'clock low
out 888,2         '8 single ended measurements selected
out 890,0         'clock high
for slow% = 0 to 1:next slow% 'stretches clock pulse
out 890,1         'clock low
out 888,oddsign%  'part of the channel selection string
swap oddsign%,toggle% 'toggles between high and low
out 890,0         'clock high
for slow% = 0 to 1:next slow% 'stretches clock pulse
out 890,1         'clock low
out 888,select1%  'part of the channel selection string
out 890,0         'clock high
for slow% = 0 to 1:next slow% 'stretches clock pulse
out 890,1         'clock low
out 888,select0%  'part of the channel selection string
out 890,0         'clock high
for slow% = 0 to 1:next slow% 'stretches clock pulse
out 890,1         'clock low

READBITS:
for bit% = 7 to 0 step -1 'MSB is first out
out 890,0         'clock high
for slow% = 0 to 1:next slow% 'stretches clock pulse
out 890,1         'clock low
ad% = inp(889)    'port 889 pin 10 7-low 135-high
if ad% < 120 then byte% = byte% + (2^bit%)
next bit%
if ch% = 0 then select1% = 0: select0% = 0: chVolts = byte% / 51
if ch% = 1 then select1% = 0: select0% = 2: chVolts = byte% / 51
if ch% = 2 then select1% = 0: select0% = 2: chVolts = byte% / 51
if ch% = 3 then select1% = 2: select0% = 0: chVolts = byte% / 51
if ch% = 4 then select1% = 2: select0% = 0: chVolts = byte% / 51
if ch% = 5 then select1% = 2: select0% = 2: chVolts = byte% / 51
if ch% = 6 then select1% = 2: select0% = 2: chVolts = byte% / 51
if ch% = 7 then select1% = 0: select0% = 0: chVolts = byte% / 51
byte% = 0
next ch%
print using "##.##":chVolts, ch1volts, ch2volts, ch3colts, ch4volts, ch5volts, ch6volts, ch7volts
wend

```

GWBasic Version

```

10 ' The following program causes the A-D converter to perform eight
20 ' sequential conversions and display the result.
30 SCREEN 0
40 COLOR 14,0
50 CLS
60 CLEAR
70 TOGGLE% = 2
80 ODDSIGN% = 0
90 IF INKEY$ < ">" THEN END
100 OUT 888,1
110 OUT 888,0
120 FOR W% = 0 TO 500:NEXT W%
130 FOR CH% = 0 TO 7
140 OUT 888,8
150 OUT 888,0
160 OUT 888,2
170 OUT 890,0
180 FOR SLOW% = 0 TO 1:NEXT SLOW%
190 OUT 890,1
200 OUT 888,2
210 OUT 890,0
220 FOR SLOW% = 0 TO 1:NEXT SLOW%
230 OUT 890,1
240 OUT 888,ODDSIGN%
250 SWAP ODDSIGN%,TOGGLE%
260 OUT 890,0
270 FOR SLOW% = 0 TO 1:NEXT SLOW%
280 OUT 890,1
290 OUT 888,SELECT1%
300 OUT 890,0
310 FOR SLOW% = 0 TO 1:NEXT SLOW%
320 OUT 890,1
330 OUT 888,SELECT0%
340 OUT 890,0
350 FOR SLOW% = 0 TO 1:NEXT SLOW%
360 OUT 890,1
370 REM
380 FOR BIT% = 7 TO 0 STEP -1
390 OUT 890,0
400 FOR SLOW% = 0 TO 1:NEXT SLOW%
410 OUT 890,1
420 AD% = INP(889)
430 IF AD% < 120 THEN BYTE% = BYTE% + (2^BIT%)
440 NEXT BIT%
450 IF CH% = 0 THEN SELECT1% = 0: SELECT0% = 0: CHVOLTS = BYTE% / 51
460 IF CH% = 1 THEN SELECT1% = 0: SELECT0% = 2: CH1VOLTS = BYTE% / 51
470 IF CH% = 2 THEN SELECT1% = 0: SELECT0% = 2: CH2VOLTS = BYTE% / 51
480 IF CH% = 3 THEN SELECT1% = 2: SELECT0% = 0: CH3VOLTS = BYTE% / 51
490 IF CH% = 4 THEN SELECT1% = 2: SELECT0% = 0: CH4VOLTS = BYTE% / 51
500 IF CH% = 5 THEN SELECT1% = 2: SELECT0% = 2: CH5VOLTS = BYTE% / 51
510 IF CH% = 6 THEN SELECT1% = 2: SELECT0% = 2: CH6VOLTS = BYTE% / 51
520 IF CH% = 7 THEN SELECT1% = 0: SELECT0% = 0: CH7VOLTS = BYTE% / 51
530 BYTE% = 0
540 next ch%
550 PRINT USING "##.##":CH0VOLTS, CH1VOLTS, CH2VOLTS, CH3COLTS,
CH4VOLTS, CH5VOLTS, CH6VOLTS, CH7VOLTS

```

fit the other pad. Do the same with the remaining components.

Position the chips on their respective solder pads just to make sure that the legs are bent properly. Make any corrections, then remove the chip and tin the pad for pin 1. Position the chip again and hold it in place under light pressure. Melt the solder on the pad until the leg is settled into the solder. Perform the same operation on pin 11, then the remainder can be soldered without applying any pressure.

Position the surface-mount regulator carefully on the pads and hold it under light pressure with a pencil eraser. Put a glob of solder on a clean iron and touch it to a pad until the solder flows around the regulator leg. There are six legs on the regulator, but legs 2 and 5 are not used.

The Sky's the Limit

Given the simple nature and small form factor of this project, it lends itself well to aerial telemetry. DTMF encoders and decoders use 5-volt logic levels too, so it seems possible to use a computer on the

ground to communicate with an ADC aboard a balloon or kite, using two low power VHF transceivers and some heavy-duty programming.

A group of local youngsters want to build and fly a huge kite. I suggested they make a science project out of it by attaching some data recording equipment and a camera. We may monitor wind speed, temperature, altitude, solar radiation, force on the string, and a few other things not yet defined. We should be able to aim and fire the camera using a computer on the ground too.

Contact Mike Gray N8KDD at 465 W. Maple Rd., Milford MI 48381.

Specifications

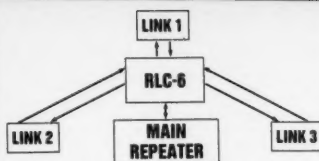
Input impedance: 30k ohms
Power consumption:
Sleep: 9 milliwatts
Wake: 100 milliwatts
Analog input: 0-5 volts
Temperature limits: 0 degrees-C

Parts List

- 1 A-D converter National ADC0838CCN or ADC0838CCJ
- 1 1 meg resistor block (contains 8 resistors)
- 1 Toko surface mount regulator, 5 volts
- 2 10k 1/8-watt resistors
- 1 4.7k 1/8-watt resistor
- 1 10 uF capacitor
- 1 9-volt battery clip
- 1 SPST toggle switch
- 1 470 ohm resistor
- 1 Low power LED
- 1 ABS enclosure with battery compartment
- 1 DB-25 connector (male)
- 1 DB-25 connector shell
- 1 6-conductor cable
- 10 Screw terminal blocks

Note: The following kits are available from the author: M-LOG programs and a circuit board only, \$25; M-LOG programs, circuit board, and components, \$60; enclosure kit (box, switch, LED, terminal blocks, graphics), \$30. Add \$3 shipping. Write to Mike Gray N8KDD at 465 W. Maple Rd., Milford MI 48381.

REPEATER LINK CONTROLLER



LINK COMM RLC-6

- ALLOWS 3 HUB OR CHAIN LINKS
- CAN BE INTERFACED TO MOST REPEATER CONTROLLERS
- DIRECT CONNECTION TO S-COMM 5/6 REPEATER CONTROLLERS
- HALF OR FULL DUPLEX LINK
- REQUIRES ONLY 3 LOGIC LINES FOR CONTROL

ONLY \$149.95
 LED DISPLAY BOARD \$29.95
 S-COM CABLE \$9.95

LINK COMM
 PO BOX 10771 • BOZEMAN, MT 59771
 (406) 587-4085

CIRCLE 47 ON READER SERVICE CARD

Micro Video Camera

Small size 1" x 2" x 3"
 Light Weight < 4oz. Low
 Power 7 - 15 volts. @
 85ma. Low Light @ 2

Lux. Camera comes com-
 plet in metal case with
 RCA plug for video out
 and two pigtailed power
 wires. Camera is presently in use in R/C
 airplanes, helicopters, cars, tanks and
 robots. Camera output is standard
 NTSC at 1v p-p, 240 line resolution with
 electronic iris. Full stock on hand.

Satisfaction Guaranteed!

Factory New, only \$229.95 + \$6
 S/H For product information and
 ordering. Call 1 (800) 473-0538

MICRO VIDEO PRODUCTS

1334 So. Shawnee Dr. Santa Ana,
 California. zip 92704 FAX (714) 545-8041

CIRCLE 30 ON READER SERVICE CARD



VIDEO I.D. BOARD



- Custom Graphics with your Call Sign
- 4 Screens (2 Hi-res/2 color bar)
- 12 VDC Operation
- Instant Video ID
- Video Relay for switching in Live Camera Video
- Built-in Automatic Sequencer-Timer (steps through all four screens)

VDG-1 with pre-programmed calls:
\$99

Call or write for catalog of available graphics

ELKTRONICS

12536 T.R. 77 • Findlay, OH 45840
 (419) 422-8206



CIRCLE 8 ON READER SERVICE CARD

**Sell YOUR used gear
 in 73 Classifieds . . .**

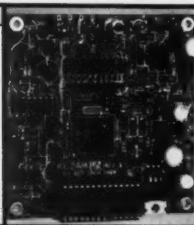
**Call Sue Colbert
 1-800-274-7373**

KE2AM's VOICE ID'er/ REPEATER CONTROLLER

COMPLETELY SELF CONTAINED—just add radios, power,
 mic, and you have a repeater. Record any voice into
 battery backup Non-Volatile RAM. On-board timers take
 care of ID, squelch tail, and time-out timing. Mixer for
 receiver and ID'er audio. Muting of receive audio during
 squelch tail. COR or squelch activated. All buffered I/O.

VER B FEATURES

- ✓ VOICE ID'er
- ✓ AUDIO MIXER 2v p-p
- ✓ 400ma TX DRIVE
- ✓ +8 TO 15v OPERATION
- ✓ TIME-OUT, ID, TIMERS
- ✓ SMALL SIZE 3.2" X 3.4"
- ✓ SQUELCH, COR KEYED
- ✓ MADE IN U.S.A.
- ✓ HIGH QUALITY
- ✓ LOW PRICE
- ✓ BATTERY BACKUP RAM
- ✓ SCHEMATICS INCLUDED



GET-TECH

201 Riley Road
 New Windsor, NY
 12553
 (814) 564-5347

SEE REVIEW OF (VER A) 73 MAG JUNE/91

NOIARI \$119.00
 ORDER BY PHONE OR MAIL, IN U.S.A.
 ADD \$5 FOR SHIPPING AND HANDLING.
 COD CHARGES ARE ADDITIONAL.

RAISED PRINT QSL CARDS

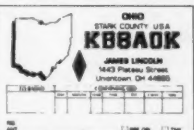
Quality you can See & Feel

Now you can have 1,000 BLUE RAISED PRINT
 cards for less than 4¢ each. Beautiful raised letter-
 ing certainly provides you with the best value in
 QSL Cards on the market. Budget QSL's are availa-
 ble on blue, yellow, gray or ivory stock & include
 your 3-D state outline for only \$39 + 3.75 shipping.
 AARL & standard logos are free! Or choose from 10
 other designs including a full color eagle. Order by
 mail or fax / phone your Visa/MC orders. Allow 3
 weeks for delivery. Samples \$1 please.

NETWORK

QSL's CARDS

P.O. Box 13200
 Alexandria, LA
 71315
 Fax 318-445-9940



ORDER LINE 800-354-0830

CIRCLE 44 ON READER SERVICE CARD

NAMLULU

Communications

- NN8Z -

-All New Versions for 92-

- 1. QSL RECORDS- \$ 19.95**
 Sort by call or select (your choice), print labels, print list, print
 any file, opr, zone, freq, rst, mode, power, phone, fax, addr,
 city, state, prov., zip, county, country, grid, select, comment,
 etc. Also a BIOSIDES utility program with benchmark, pc equip,
 etc.
- 2. CALCULATE- \$ 17.95**
 Loaded, just enter data- it will respond, power, area, inch,
 metric, weight, capacity, temperature, teaspoon, transformers,
 capacitor, inductor, resistor, reactance, wave length, ohms law,
 impedance, rf frequency, memory, antennas, longwire, dipole,
 wave length & coax.
- 3. PHONE ADDRESS LIST- \$ 11.95**
 Sort by name or category (your choice), labels, list, phone, fax,
 addr, city, state, prov, country, category, comment. Every
 business and home soul have one.
- 4. HAVING FUN WITH TURBO PASCAL- \$ 3.95 to \$ 6.95**
 Learn programming the easy way. You get the running
 program and the source code. You need a compiler.
- 5. PC MELODIES- \$ 4.95**
 Binary coded music for xyl, yl, om. Give yourself a break
 today.

FOR AT, XT, PC COMPATIBLES. COLOR/MONO AUTO
 DETECT DEMOS ARE \$ 2.95 - OHIO RESIDENTS ADD
 6% SALES TAX

1120 MEADOWVIEW ROAD
 WILLARD, OHIO 44890

73

CIRCLE 141 ON READER SERVICE CARD

HIGH POWER RF SWITCHED PREAMPS



Model 145
\$184
 Model 1460S
\$184
 Model 440
\$196

Model 146 160W 2 Meters 19db Gain .75db NF
 Model 1460S 160W 2 Meters 19db Gain .75db NF
 Model 440 70cm 100W 16db Gain .75db NF

All preamps have helical filters to prevent out of
 band intermodulation in the receiver. Model 146
 covers the entire 2 meter band. Model 1460S is
 of very narrow bandwidth and would be suitable
 for SSB. Packet, or Satellite. Model 440 is factory
 tunable from 430-440 MHz or 440-450 MHz per
 customer request. All models are powered with
 13 to 20 VDC and are mounted at the antenna.

AMPIRE, INC.
 10240 NATHAN LANE
 MAPLE GROVE, MINN 55369 612-425-7709

SCARED OF THE CODE?

IT'S A SNAP WITH THE ELEGANTLY SIMPLE
 MORSE TUTOR ADVANCED EDITION FOR
 BEGINNERS TO EXPERTS—AND BEYOND

Morse Code teaching software from GGTE is the
 most popular in the world—and for good reason.
 You'll learn quickest with the most modern teaching
 methods—including Farnsworth or standard code,
 on-screen flashcards, random characters, words and
 billions of conversations guaranteed to contain every
 required character every time—in 12 easy lessons.

Sneak through bothersome plateaus in one tenth of
 a word per minute steps. Or, create your own drills
 and play them, print them and save them to disk.
 Import, analyze and convert text to code for additional
 drills.

Get the software the ARRL sells and uses to create
 their practice and test tapes. Morse Tutor Advanced
 Edition is approved for VE exams at all levels. Morse
 Tutor is great—Morse Tutor Advanced Edition is even
 better—and it's in user selectable color. Order yours
 today.

For all MS-DOS computers (including laptops).
 Available at dealers, thru QST or 73 or send \$29.95
 + \$3 S&H (CA residents add 7.75% tax) to:
 GGTE, P.O. Box 3405, Dept. MS,
 Newport Beach, CA 92659
 Specify 514 or 314 inch disk
 (price includes 1 year of free upgrades)



73

CIRCLE 193 ON READER SERVICE CARD

by Michael Jay Geier KB1UM

The Yaesu FT-415 Handheld

A full-featured 2m mini-HT.

Yaesu USA
17210 Edwards Rd.
Cerritos CA 90701
(310) 404-2700
Price class: \$409

Yaesu's new FT-415 is an interesting melding of the FT-26 and the FT-411. It incorporates nearly all of the FT-411's features, along with the DTMF paging and squelch of the FT-26. It is styled like the '26, with a slightly thicker case than the 411's, but reduced size in the other dimensions. It is sculpted and rounded, so it feels comfortable.

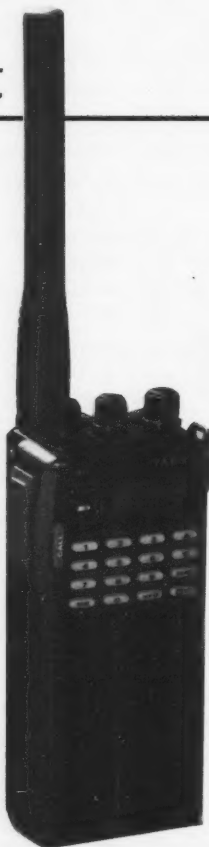
Basics

This is a full-featured radio. It includes all of the goodies we've come to expect from today's high-tech rigs, along with a few brand-new ones. Receive coverage is Yaesu's now-standard 130-174 MHz, and transmit is 140-150 MHz. Power output with the standard battery is 2 watts on high. There are 41 memories, each capable of holding independent TX/RX frequencies, CTCSS tone and configuration, etc. DTMF paging is included.

Although CTCSS is listed in the manual as an option, it comes installed on all USA/Canada rigs, as it always has on the FT-411 (but not on the FT-26).

The radio is noticeably smaller than the FT-411, except for its slightly increased thickness. The PTT switch area does not stick out as far, and the rubber PTT, Monitor and Lamp switches are curved for better ergonomics. It looks much nicer, but I'm not sure that it really works; I found the '411's PTT less fatiguing to press than the new version. Also, I sometimes find myself turning the lamp on when I press the PTT. The 16-button keypad controls almost everything; there are no hidden switches on the back. The "call" button, which selects your favorite frequency at the touch of one button, is on the front, near the PTT switch area, and is easier to get at than the '411's was. On top, next to the mike and earphone jacks, is a coaxial jack for direct DC input. The rig can operate on 5.5 to 16 volts, so you can power it from your car. At 12 volts, output is 5 watts. The rig is fairly weather-proofed, with a rubber cover over the jacks and a grommet around the antenna jack. The manual says it is ruggedized and I believe it; this thing feels solid as a rock.

The antenna is the same as the one on the FT-26: way too stiff. Also, its cover is not



The Yaesu FT-415 HT.

securely attached and turns freely, making antenna removal difficult. It seems that most walkie manufacturers like to change their ducks' styles every now and then. Yaesu might want to rethink this one.

The included 600 mAh NiCd battery pack also is the same kind as used on the FT-26. It can be charged with the standard wall charger in about 15 hours, or with the optional quick charger in about an hour. Along with several sizes of rechargeable packs, there's an optional AA cell holder, which can be mighty handy in public service work or when you travel and don't want to bring a charger along. By the way, this new battery style does not fit on the FT-411 and previous units.

It Does It

This radio has every feature you could

want, and then some. Anything you want it to do, it does it. It has all the usual scan and priority modes, along with a programmable battery saver and automatic power-off timer. The battery saver has the new feature also included on the FT-26: It can analyze your operating habits and typical channel activity and set itself for optimum operation with the least intrusive characteristics. If you don't want it to do that, you can set it to one of five fixed on/off ratios or turn it off altogether for packet operation. When you select the saver ratio, the time between "wake ups" is displayed in seconds. It's pretty slick. There are four RF output power levels, but only three are available at the normal 7.2 volts supplied by the standard battery. Still, that's one more than you usually get. To save even more power, you can elect to disable the front-panel "busy" LED. I don't understand why an LED is even used; this function could be shown on the LCD with no added power drain. But, it's nice to be able to save the 5 mA or so the LED eats.

Frequencies may be entered with the keypad or by using the top-mounted rotary tuning control. This configuration has pretty much become standard these days, and it works well. The rotary tuning knob can shift the frequency by either the nominal step you have selected (such as 5 kHz) or by 1 MHz in conjunction with the MHz function available on the keypad. When you enter frequencies directly from the keypad, you must enter all the digits, including the leading "1." There's even an option which lets you enter "splinter" channels (in between the normal 5 kHz channels) without changing the basic tuning step.

Like the FT-411, the '415 has two VFOs, and any memory can be used as a VFO as well. Pressing one button converts whatever memory channel you are on into a tunable memory, which is no different at all from a VFO. If you wish to replace the memory contents with the new frequency you have found, you may do so. You also may put the new frequency into a different memory without disturbing the memory from which it came. Finally, you may simply ignore the new frequency and return to the original memory with no harm done.

EASY ORDER
1-800-582-4044

Maldol

EASY FAX
1-800-582-1255

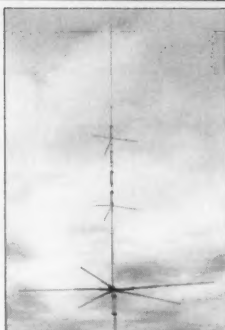
PRESENTED BY EASYTECH

5 BAND HF VERTICAL ANTENNA

1/4 Wave - 3.5/7/14/21 & 28 MHz Adjustable Radiator & Radials UPS Shippable

Ideal where space is limited. This easy to assemble HF vertical antenna features stainless steel hardware and a trap design at an attractive price. It can be assembled with the radials to one side for mounting close to a wall.

- Stainless steel hardware
- Ground plane design mounts at any height
- Max. Input: 500W SSB, 250W CW
3.5 MHz - 200W SSB
- Height: 20'
- 5 Radials (Longest: 51")
- Connector: SO239 Jack



Order #	Price	Description	Weight
HSVK5JR	297.00	5 Band HF Vertical Antenna	17.5 lbs.

HT RUBBER ANTENNAS

AH212

- Features**
- Freq.: 144/440/1200MHz
 - Gain: U 144MHz
3.0dB 440MHz
5.5dB 1200MHz
 - Max. Input: 20W (FM)
 - Length: 14" (350 mm)
 - Connector: BNC Male

Compact helical formed antennas are flexible and forgiving. Two short single band models and two multi-band designs with coverage to 900 or 1200MHz with gain on the UHF bands. The HG and AH models feature a black low gloss finish, and the HS models are grey silicone rubber.

HG600B

- Features**
- Freq.: 144/440/900MHz
 - Gain: U 144MHz
1.9dB 440MHz
3.6dB 900MHz
 - Max. Input: 10W (FM)
 - Length: 12.5" (320 mm)
 - Connector: BNC Male

HS2RB, HS70RB

- Features**
- Material: Silicone Rubber
 - Max. Input: 5W (FM)
 - Length: 4.33" (110 mm)
 - Connector: BNC Male

HS70RB

3 Band HT
Deluxe Black Whip

HS2RB

Order #	Price	Description	Weight
AH212	44.80	144/440/1200MHz Whip Antenna	4 oz.
HG600B	37.80	144/440/900MHz Whip Antenna	4 oz.
HS2RB	12.80	144MHz Whip Antenna	8 oz.
HS70RB	12.80	440MHz Whip Antenna	8 oz.

HEAVY DUTY TRUNK/HATCH MOUNT

Matte Black Finish

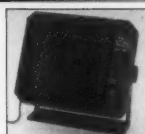
Features inserts for the protection of your vehicle while mounted!

- Heavy Duty
- Universal
- Zinc Die-Cast
- Adjustable Mounting Angle



Order #	Price	Description	Weight
BM1	29.00	Trunk/Hatch Mount	13 oz.

EXTERNAL SPEAKERS

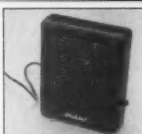


HSP6000

4" speaker with switchable noise filter
Size: 4.33" x 5.32" x 2.13" (HxWxD)

Commercial Grade External Communications Speakers

- Impedance: 8Ω
- Connector: 3.5mm plug



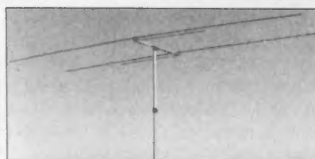
HSP7000

2.75" fixed cone speaker with high quality, deluxe magnet mount
Size: 3.51" x 4.06" x 1.42" (HxWxD)

Order #	Price	Description	Max. Input	Weight
HSP6000	29.00	4" Fixed Cone Speaker	15W	15 oz.
HSP7000	37.00	2.75" Fixed Cone Speaker	8W	13 oz.

HB9CV Type UPS Shippable

Dual driven elements at an affordable price. These high quality 6 and 10 meter antennas have an outstanding design that has gained wide acceptance for being dependable as well as compact.



50HS2HB - 6 Meter

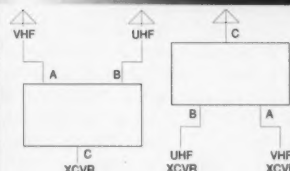
- Max. Input: 500W (SSB), 250W (FM)
- Gain: Better than 6.0 dB
- FBR: Better than 16 dB
- Element Length: 116" (2,970 mm)
- Boom Length: 31" (780 mm)
- Connector: SO239 Jack

28HS2HB - 10 Meter

- Max. Input: 500W (SSB), 250W (FM)
- Gain: Better than 6.0 dB
- FBR: Better than 16 dB
- Element Length: 212" (5,400 mm)
- Boom Length: 53" (1,340 mm)
- Connector: SO239 Jack

Order #	Price	Description	Weight
28HS2HB	99.50	28MHz, 10 Meter Horizontal Beam	7.6 lbs.
50HS2HB	69.50	50MHz, 6 Meter Horizontal Beam	5.6 lbs.

LOW-LOSS DUPLEXERS



- Frequency: Port A - 1.6 to 150MHz
Port B - 410 to 460MHz
Port C - Common
- Insertion Loss: Port A-C - 0.15dB
Port B-C - 0.25dB
- Isolation: Port A-B-60dB
- VSWR: <1.2
- Size (HxWxD): 1.2" x 2.5" x 1.9"
(Excluding Connectors)

- Power: 1.6 to 30MHz Max. 500W (FM)
50 to 150MHz Max. 300W (FM)
410 to 461MHz Max. 300W (FM)

- Connectors: A B C
HS790D UHFm UHFm UHFf
HS790DN UHFm Nm UHFf
HS790WP UHFf UHFf UHFf
m= male, f= female

- Weather Proof Model: HS790WP comes with mounting bracket and stainless steel clamp

Order #	Price	Description	Weight
HS790D	47.50	Direct Link Duplexer	9 oz.
HS790DN	47.50	Direct Link Duplexer	9 oz.
HS790WP	58.00	Direct Link Duplexer, Weather Proof	14 oz.

EASYTECH



2917 Bayview Drive
Fremont, CA 94538



Easy Order: 1-800-582-4044
Easy Fax: 1-800-582-1255

International Fax: 1-510-770-2346
Customer Service: 1-510-770-2345

Monday-Friday, 7am - 5pm (PST)/10am-8pm (EST)

- ☒ COD (USA only)-No personal checks, US funds (\$5.00 Surcharge)
- ☒ USPS ☒ UPS ☒ Federal Express ☒ Airborne
- For UPS Ground - Add \$4.00 for the first 2 lbs. and \$.50 for each additional pound.

Shipping charges based on weight.

Call or write today for your free copy of our 64 page catalog.

California residents, add appropriate sales tax.
12 month warranty on all EasyTech products.
30 day money back guarantee.
We reserve the right to substitute manufacturers.
Prices subject to change without notice.
CIRCLE 9 ON READER SERVICE CARD

The front-mounted LCD shows operating frequency, memory channel number, VFO A or B, and other functions such as CTCSS status. It appears identical to the display on the '26, and is very nice. It shows the full frequency, including the final zero or five, and I like that. The display can be backlit by pressing the lamp button just below the PTT switch. The keypad lights up at the same time, making night operation very convenient. Green LEDs are used for both the keypad and the LCD; gone is the incandescent lamp on the '411. The lighting can be set to stay on for five seconds after the last key press, or to stay on until you press the lamp button again, which is nice for nighttime mobile operation from car DC power. For normal battery operation, the five-second time-out is especially handy. Of course, you can turn the lights off any time you want simply by pressing the lamp button.

The rig can scan the band, a selected portion of the band, or the memories. Scanning the band, or a portion of it, from the VFO is very fast. Memory scan, however, is only about half the speed of the '411. Still, it's as fast as most rigs; the '411 was exceptional in that regard.

Memories can be locked out in two ways. SKIP hides the memory channel from the scan, but you can still get to it via the tuning knob or by entering the channel number from the keypad. It's great for the NOAA weather channel or other busy frequencies. HIDE erases a memory completely, except that you can "unhide" it later and get it back. I find this feature to be especially useful for travel. If you often visit different cities, you'll love it. But, as on previous Yaesu walkies, each memory channel must be hidden and retrieved separately. It would have been nice if there were some way to manipulate whole ranges (such as 20-29) at a time, but it still beats having to re-enter all those frequencies. There's an improvement over previous rigs, though. It used to be that when you hid a memory, the rig dropped back to memory number 1 after each HIDE operation. It was a real pain to hide an entire range because you had to enter each memory number and essentially start over for each one. The new rig simply drops back to the first unhidden previous memory. So, if you hide channel 5, it drops back to channel 4, assuming that one is unhidden. This makes it much easier to get rid of an entire range, especially if you start at the highest number and work backward.

The memory management scheme of this new radio is essentially identical to the time-proven, easy-to-use design of the FT-411. It will even scan up or down the band from the memory. After scanning to a new frequency, you can store it in any memory channel or a VFO, or simply return to your original memory channel, disturbing nothing. It's all very easy to do and easy to remember.

The FT-415 has some new features, including DTMF paging, four power level choices, an automatic battery saver, lighting options, selectable two-second TX hang time

during DTMF dialing, CTCSS scanning (it'll decode and display incoming tones!), and lots more. In order to accommodate these new capabilities, a new SET mode, similar to the one used on ICOM walkies, is included. Many of the infrequently used set-up commands are grouped in this mode, keeping them out of your way until needed. The key presses seem straightforward enough, but you probably will need to refer to the manual for the ones you don't use very often.

Like the FT-411, this new rig has a 10-number DTMF autodialer. Each number can have up to 15 digits, and sending them is as easy as touching one button while you're transmitting. (Some rigs make you press as many as four buttons, negating the whole point of an autodialer.) The procedure for entering the numbers is the same cryptic system found on the '411, and I think it could be made easier. Once you get the hang of it, though, it's not too bad, and it's definitely worth it. Naturally, you also may send numbers manually, without entering them into memory first.

Documentation

The manual is first-rate. Like other recent Yaesu booklets, it's written in clear English. I wish other manufacturers would put this much effort into their instructions. A full set of schematics is provided, and there's a lovely wallet-sized cheat sheet. This sheet, unfortunately, doesn't show some of the SET functions, but it has all of the operations you're likely to want out in the field. It's made of a coated paper which seems designed to last a long time.

Using It

Transmitted audio sounds clear. The receiver is very sensitive, even outside the ham bands. It's a definite improvement over the '411s. Selectivity is very good, but doesn't seem quite as sharp as the older rig. Still, it's better than on many other walkies, and more than good enough. Unlike most walkies the 415's front end filters are varactor controlled by the PLL tuning voltage, so they are always tuned to the operating frequency. This Advanced Tracked Tuning technique keeps the sensitivity high and helps avoid intermod problems. Overall, the receiver seems excellent. I tried the rig on packet using the Poor Man's Packet modem I built up for my '411, and it worked great. Naturally, I turned the battery saver off first!

Not Perfect

Each generation of walkies gets better than the last. This rig is really great, but it does have a few quirks and annoyances. Here are some I found.

There's one bug that's a carry-over from the '411: When you are in the CALL memory, if you turn the dial knob, it transfers the contents of the memory into the last-used VFO, trashing whatever was there. It can be a real pain when you inadvertently lose a stored frequency that way.

The rig is touted to have improved receive

audio by virtue of a better speaker. It's true. Despite the small grille area, the speaker reproduces bass frequencies much better, making most voices (especially men's) sound richer and clearer. The audio obviously is better than on previous models.

The DTMF squelch and paging features use the now-standard three- and six-tone sequences, with the numbers being limited to 0-9. Unfortunately, most repeater controllers won't pass DTMF tones unless they're prefaced by some codes containing the * and #, which you can't send. This limitation makes the features fairly useless, especially in the big cities where you'd most like to use them. This problem isn't limited to Yaesu, though; all the DTMF-squelched rigs use the same system. Of course, it's nice for simplex and hamfest use.

The same blinking battery icon that was on the '411 is present on the new rig. Like the old one, it doesn't give you much warning when your battery is about to die. A voltage monitor would be far preferable. Even though NiCd batteries don't change voltage much over their discharge period, there's enough change near the end to give you more warning than the icon does.

The rig gives you the option to substitute DTMF tones for the annoying musical keypad beeper. It's an improvement, but still not great. It would be nice if there were an option to change the beeper into a single short tone, like it used to be on older walkies, perhaps with a double tone for those functions whose status is announced via the beeper.

The NC-42 Quick Charger

Along with the review rig Yaesu sent the NC-42 quick charger. This small, light unit sits on a desktop. It has no on/off switch; it turns itself on when you insert the battery. It begins in the quick mode and brings the battery to a nearly full charge in about one hour. It then switches to the trickle mode, topping off the charge. Two LEDs announce the charge mode. It works well and is very convenient, but it suffers from one problem: It throws the worst TVI I've ever seen! I have some Sony miniature switching power supplies which have the same problem, but they're not nearly this pronounced. This thing puts garbage on any TV screen in the house, including my set which is hooked up to the outdoor antenna via coax. Some shielding is in order here! Wouldn't it be ironic to get complaints from your neighbors about your battery charger instead of about your transmitter? [Ed. Note: Yaesu is currently looking into this.]

Conclusion

This radio represents the state of the art in miniature single-band walkies. No, it isn't the very smallest available, but it's certainly small enough! It works well and has more features than you'll probably ever use. Considering the wealth of functions, the user interface is very reasonable and unimposing. This rig's a beauty!

LOGic

New version!

Now more than ever!

Many hams have selected LOGic for its many unique features, high quality, reliability, reasonable price, and superb support.

LOGic version 2.12 features easy online tracking for any award, including 1010, WPX, and grid-squares. Multitasks under Windows 3 or DesqView. LOGic II now features:

- optional QSL route database with automatic cross-reference
- integration with HamBase and SAM "call book" databases
- automatic county logging from the J-Comm county database.

LOGic Jr. is still only \$39.00. LOGic II, which features contesting, interface to most rigs, custom report writer, and more, is only \$79. For IBM, Amiga, and ST. Coming for Mac. Ask for free 10-page info pak.

Hours:
8 AM - 6 PM M - Th
8 AM - Noon Fri

Personal Database Applications
2616 Meadow Ridge Dr., dept 7
Duluth, GA 30136-6037
☎ 404-242-0887 Fax 404-449-6687



PERFORMANCE
AND VALUE
WITHOUT COMPROMISE

KRP-5000 REPEATER

2 METERS-220-440

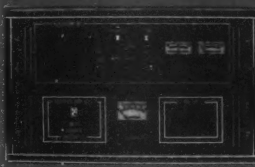
Word is spreading fast—Nothing matches the KRP-5000 for total performance and value. Not GE, not even Motorola.

If performance really counts on a tough repeater environment, so the KRP-5000 receiver gives you 7 helical resonators, 12 poles of IF filtering, and a precise Schmitt trigger squelch with automatic threshold switching. The transmitter gives you clean TMOS FET power.

Enjoy high performance operation with remote programmability, sequential tone paging, autopatch, reverse autopatch, 200-number autodial, remote squelch setting, status inputs, control outputs, and field-programmable Morse messages.

Call or write for the full performance story... and the super value price!

Micro Control Specialties
23 Elm Park, Groveland, MA 01834
(508) 372-3442



KRP-5000 Repeater shown with PA-100 Amplifier

The first choice in
Transmitters - Receivers
Repeaters
Repeater Controllers
Power Amplifiers
Voice Mail Systems

CIRCLE 144 ON READER SERVICE CARD



P.O. Box 6522
220 N. Fulton Ave.
Evansville, IN 47719-0522

Store Hours
MON-FRI: 8 AM - 5 PM
SAT: 9 AM - 3 PM
CENTRAL TIME

SEND A SELF ADDRESSED STAMPED
(2 STAMPS) ENVELOPE (SASE) FOR
NEW AND USED EQUIPMENT SHEETS.

WARRANTY SERVICE CENTER FOR:
ICOM, KENWOOD, YAESU

FOR SERVICE INFORMATION CALL
(812) 422-0252
MONDAY - FRIDAY

TERMS:
Prices Do Not Include Shipping.
Price and Availability Subject to
Change Without Notice
Most Orders Shipped The Same Day
COD's Welcome



AEA	
PK-232MBX Multi-Mode Controller	\$314.95
PK-88 RS-232 Packet Controller	134.95
PCB-88 Packet Board—IBM	164.95
Isopole 144—2 Meter	52.95
ALINCO (HUGE INVENTORY—PLEASE CALL)	
DR-599T 2M/440 MHz Deluxe Mobile	\$639.95
DR-570T 45W 2M/35W UHF	CALL
DR-119T 50W 2 Meter	CALL
DU-F1 2M, 5W HT	CALL
DU-580T 2M/440 HT	CALL
DU-162TD Deluxe 2M, HT	229.95
ALLIANCE	
HD-73 Rotator	\$175.00
A-105	59.95
AMERITRON	
AL-811 three 811A Tubes	\$579.95
AL-80A 1KW Amplifier	974.95
RCS-4V 4 Position Wireless	129.95
ASTRON	
RS-20A 16-20 Amp.	\$94.95
RS-35A 25-35 Amp.	144.95
RS-20M 16-20 Amp. w/Meters	114.95
RS-35M 25-35 Amp. w/Meters	159.95
RS-50M 37-50 Amp. w/Meters	229.95
BUTTERNUT	
HF6VX 6 Band Vertical	\$174.95
A17-12 17 & 12 Meter Kit	48.95
TBR-160S 160M	64.95
CSI	
800 New Interconnect	\$309.95
P.P. V Multi-Mode Interconnect	479.95
COMET	
CA-2xMAX 2M/440 4.5/11.9 18'4"	\$169.95
CA-2xFX 2M/440 4.5/2.2 5'11"	94.95
CX-224 2M/220/440 Triband Mobile	66.95

CUSHCRAFT	
A4S HF Tribander	\$379.95
A3S 10, 15, 20M Tribander	319.95
R7 Seven Band Vertical	369.95
DIAMOND	
X-200 6/8 db 8.3' 2M/440	\$134.95
X-500NA 8.3/11.7db 17.2' 2M/440	179.95
HEIL	
IC-735 Gen. Cov. Xcvr	\$77.95
ICOM	
IC-728 New HF Transceiver	CALL
IC-765 Gen. Cov. Xcvr/PS/Tuner	CALL
IC-751A Gen. Cov. Xcvr	CALL
IC-735 Gen. Cov. Xcvr	CALL
IC-725 Gen. Cov. Xcvr	CALL
IC-2410 VHF/UHF 45W/35W	CALL
IC-229H 50W FM	CALL
IC-901 Fiber Optic	CALL
IC-W2A 2M/440 Handheld Xcvr	CALL
IC-P2AT 2.5W 2M Handheld Xcvr	CALL
IC-26AT 7W 2M Handheld Rec.	CALL
IC-25RA 2M, HT w/50kHz-905MHz Xcvr	CALL
KANTRONICS	
KAM All Mode	\$279.95
KPC-2 Packet Controller	159.95
KENWOOD	
TS-950SDX Deluxe Digital Xcvr	CALL
TS-850SAT Xcvr w/Receiver, Tuner	CALL
TS-450SAT Compact Xcvr	CALL
TM-741A 50W, 2M/440MHz	CALL
TM-641A 2M/220MHz, FM Xcvr	CALL
TM-241A 50W, 2M, FM, HT	CALL
TM-732A New 2M/440 Mobile	CALL
TH-28A New 2 Meter Handheld	CALL
TH-78A New 2M/440 Handheld	CALL
LAUREN	
2M, 440 MHz Mag Mount Antenna	\$62.95

MFJ (LARGE STOCK—COMPETITIVE PRICES)	
989C 3KW PEP Antenna Tuner	\$299.95
986 3KW PEP Antenna Tuner	254.95
921 300W, 2M/220 Tuner	62.95
9490 300W Mtr/DL/Switch/Bin	129.95
207 HF SWR Analyzer	89.95
422B Keyer/Paddle Combination	124.95
815B 1.8-30 MHz RMS/PEP	59.95
1214 Color Fax, RTTY, CW, ASCII	149.95
1278T Turbo Multi-Mode Cntr	309.95
1278 Multi-Mode Controller	244.95
1274 Packet Controller	139.95
1270B TAPR TNC-2 Clone	119.95
247 SWR Analyzer W/Freq. Counter	169.95
346 LCD Frequency Counter	159.95
RF Concepts	
2-23/30W 2M Amp w/Pre-amp	\$119.95
2-317 30/170W 2M Amp	244.95
4-110 10/100W 440MHz Amp	324.95
2/706 3/30-5/20W 2M/440 Amp	234.95
STANDARD	
C228A 2M/220 MHz HT w/CTCSS	\$544.95
C528A 2M/440MHz HT w/CTCSS	\$24.95
C168A 2M Sub-Mini Deluxe HT	345.95
TEN-TEC	
Omni-VI New HF w/DSP	CALL
VALOR	
PA-555 2M/440 Base Antenna	159.95
YAESU (LARGE STOCK—PLEASE CALL)	
FT-1000D 200W Deluxe HF Xcvr	CALL
FT-1000 200W HF Xcvr	CALL
FT-990 100W HF Xcvr	CALL
FT-890 High Performance HF Xcvr	CALL
FT-767 Gen. Cov. Xcvr/PS/Tuner	CALL
FT-747GX HF Xcvr	CALL
FT-736R Xcvr 144-148, 430-450	CALL
FT-5200 2M/440 50/35W	CALL
FT-2400H 2M 50W	CALL
FT-415 Deluxe 2M, HT	CALL

LARGE STOCK OF USED EQUIPMENT.

ORDERS & PRICE CHECKS
800-729-4373

NATIONWIDE & CANADA

LOCAL INFORMATION
812-422-0231

FAX 812-422-4253

CIRCLE 131 ON READER SERVICE CARD
73 Amateur Radio Today • July, 1992 49

Protected AC Outlet for the Workbench

Avoid a shocking experience.

by Michael A. Covington N4TMI

My most-used test bench accessory is a switched AC outlet with a ground-fault circuit interrupter (GFCI) and a precision 0.1-ohm resistor.

Photo A shows what it looks like. The GFCI is a standard model from a hardware store, mounted in a not-too-precisely-cut hole in the enclosure. It serves three purposes: to help keep me from getting shocked; to detect potentially unsafe equipment; and to let me know whether any piece of equipment is going to trip a GFCI, even for harmless reasons.

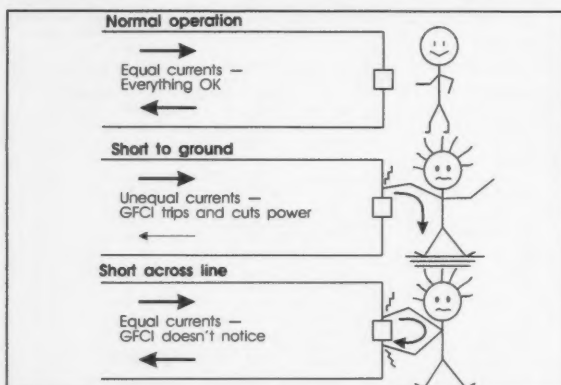


Figure 1. The ground-fault circuit interrupter (GFCI) senses mismatched currents in "live" and "neutral" wires and cuts off power. This doesn't prevent all electric shocks—only those involving a short to ground (middle example).

Figure 1 shows what a GFCI does: It checks whether the currents in the "live" and "neutral" wires are equal, and, if not, cuts off the current. This doesn't prevent all electric shocks, but it does prevent or shorten those that involve an accidental connection to ground.

The circuit is shown in Figure 2. Ahead of the GFCI are a switch and a 0.1-ohm resistor. The switch, naturally, cuts power on and off. It should be rated for as many amps as your load will ever draw (typically 10 or so).

The resistor lets you measure AC current accurately—just connect a voltmeter across it and read each volt as 10 amps. An 0.1-ohm, 10-watt resistor may be a bit hard to

find; the easiest solution is to use five 0.47-ohm, 5-watt resistors (Radio Shack 271-130) in parallel.

You'll also need two pin jacks for the voltmeter. Remember that both sides of the resistor are "hot" with respect to ground; don't use any kind of jack that could make accidental contact with something or someone outside. Binding posts are not suitable. The Radio Shack 274-725 banana jacks are barely acceptable if clearly marked with a warning label; jacks with much smaller holes are preferable, and can be found at hamfests or on junked test equipment. Or you could make something of your own that mounts behind tiny holes drilled in the



Photo A. This device consists of a GFCI (ground-fault circuit interrupter) in a convenient enclosure with a switch.

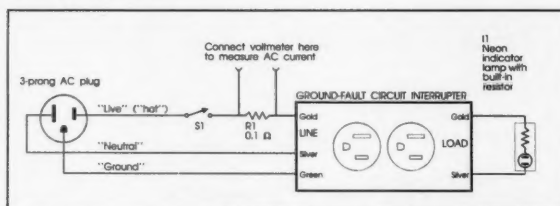


Figure 2. The protected outlet box consists of a GFCI, a switch, a 0.1 ohm resistor for measuring current, and a pilot lamp. Correct identification of live, neutral, and ground wires is VERY important. Most power cords use the black wire for the "hot" live lead; the white wire is the neutral and the green wire is the ground.

plastic panel.

The GFCI can come from any hardware store. It's essential not to mix up the live ("hot"), neutral, and ground wires in the power cord and on the GFCI. In most power cords the black wire is the "hot" lead, the white wire is the neutral and the green wire is the ground. The switch *must* be in the live ("hot") wire. Also, be sure to distinguish the input ("line") side of the GFCI from the output ("load"). Across the load side of my GFCI I wired a neon indicator lamp so that I can see at a glance whether power is on.

Contact Michael A. Covington N4TMI, 285 Saint George Drive, Athens GA 30606.

Parts List

- S1 SPST switch, rated for 125V AC, 10 amperes (Radio Shack 275-324 or equivalent)
- R1 0.1-ohm, 10 watt resistors (actually five 0.47 ohm, 5-watt resistors in parallel, Radio Shack 271-130)
- I1 Neon lamp "power on" indicator with built-in resistor (Radio Shack 272-712 or equivalent)
- GFCI Ground fault circuit interrupter (from hardware store or electrical supply house)

Pin jacks for voltmeter connections (see text)
Enclosure

3-prong AC plug and line cord

GaAs FET PREAMPS

at a fraction of the cost of comparable units!

LNG-(*)

ONLY \$59

wired/tested



FEATURES:

- Very low noise: 0.7dB vhf, 0.8dB uhf
- High gain: 13-20dB, depends on freq
- Wide dynamic range - resist overload
- Stable: low-feedback dual-gate FET

*Specify tuning range: 26-30, 46-56, 137-150, 150-172, 210-230, 400-470, 800-980 MHz.



LNW-(*) MINIATURE PREAMP

ONLY \$29 kit, \$44 wired/tested

- GaAs FET Preamp similar to LNG, except designed for low cost & small size. Only 5/8" W x 1-5/8" L x 3/4" H. Easy mounts in many radios.

*Specify tuning range: 25-35, 35-55, 55-90, 90-120, 120-150, 150-200, 200-270, 400-500 MHz.

LNS-(*)

IN-LINE PREAMP

ONLY \$89 kit, \$119 wired/tested

- GaAs FET Preamp with features similar to LNG series, except automatically switches out of line during transmit. Use with base or mobile transceivers up to 25W. Tower mounting brackets incl.

*Specify tuning range: 120-175, 200-240, or 400-500 MHz.

HELICAL RESONATOR PREAMPS

GaAs FET preamps with 3 or 4 section helical resonators reduce intermod & cross-band interference in critical applications. **MODEL HRG-(*)**, \$80 vhf, \$110 uhf. *Specify tuning range: 142-150, 150-162, 162-174, 213-233, 420-470 MHz.



RECEIVING CONVERTERS

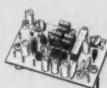
Low noise converters to receive vhf and uhf bands on a 10M receiver. Choice of kit with case & BNC jacks, kit less case \$49, kit w/case \$74, w/t in case \$99. Request catalog for complete listings.

- VHF input ranges avail: 136-138, 144-146, 145-147, 148-148 MHz.
- UHF input ranges avail: 432-434, 435-437, 435.5-437.5 MHz.

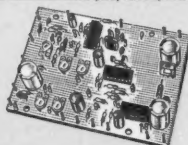
TRANSMITTING CONVERTERS

XV2 for vhf and XV4 for uhf. Models to convert 10M ssb, cw, fm, etc. to 2M, 432, 435, and for atv. 1W output. Kit only \$89. PA's up to 45W available. Request catalog for complete listings.

ACCESSORIES

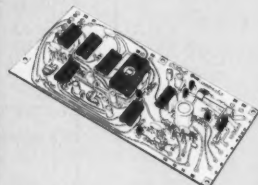


TD-3 SUBAUDIBLE TONE DECODER/ENCODER. Adjustable for any tone. Designed especially for repeaters, with remote control activate/deactivate provisionskit \$29, wired/tested \$69

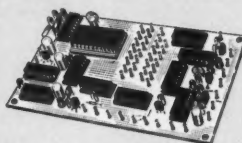


COR-3 REPEATER CONTROLLER. Features adjustable tail and time-out timers, solid-state relay, courtesy beep, and local speaker amplifierkit \$49

CWID. Diode programmed any time in the field, adjustable tone, speed, and timer, to go with COR-3kit \$59



COR-4 kit. Complete COR and CWID all on one board for easy construction. CMOS logic for low power consumption. Many new features. EPROM programmed; specify call kit \$99, w/t \$159



TD-2 TOUCH-TONE DECODER/CONTROLLER kit. Full 16 digits, with toll-call restrictor, programmable. Can turn 5 functions on/off. Great for selective calling, toolkit \$89, wired/tested \$149

AP-3 AUTOPATCH kit. Use with above for repeater autopatch. Reverse patch and phone line remote control are stdkit \$89, wired/tested \$149

AP-2 SIMPLEX AUTOPATCH Timing Board kit. Use with above for simplex operation using a transceiverkit \$39



MO-202 FSK DATA MODULATOR kit. Run up to 1200 baud digital signals through any fm transmitter with full handshakes. Radio link computers, telemetry gear, etc.kit \$49, w/t \$79

DE-202 FSK DEMODULATOR kit. For receive end of link.kit \$49, w/t \$79

9600 BAUD DIGITAL RF LINKS. Low-cost packet networking system, consisting of new MO-96 Modem and special versions of our 220 or 450 mHz FM Transmitters and Receivers. Interface directly with most TNC's. Fast, diode-switched PA's output 15 or 50W.

If you always thought a microprocessor-controlled repeater had to be expensive, LOOK AGAIN! You could easily spend this much just for a controller.

REP-200 REPEATER

A premium repeater with autopatch and many versatile dtmf control features at less than many charge for a bare-bones repeater! We don't skimp on rf modules, either! Check the features on R144 Receiver, for instance: GaAs FET front-end, helical resonators, sharp crystal filters, hysteresis squelch.

Kit \$1095; w/t only \$1295!



Other models available:

REP-200V Economy Repeater Kit. As above, except uses COR-4 Controller without DTMF control or autopatch. Kit only \$795.
REP-200N Repeater with no controller. For use with external controller, such as those made by ACC. Kit only \$695, w/t \$995.

- Available for the 143-174, 213-233, 420-475, 902-928 MHz bands.
- FCC type accepted for commercial service (vhf and uhf).
- Rugged exciter and PA, designed for continuous duty.
- Power out 15W (25W option) 143-174 MHz; 15W 213-233; 10W uhf or 902-928MHz.
- Accessory add-on PA's available with power levels up to 100W.
- Six courtesy beep types, including two pleasant, sequential, multi-tone bursts.
- AUTOPATCH: either open or closed access, toll-call restrict, auto-disconnect.
- Reverse Autopatch: two types, auto-answer or ring tone on the air.
- Pulse (rotary) dial option available.
- DTMF CONTROL: over 45 functions can be controlled by touch-tone. Separate 4-digit control code for each function, plus extra 4-digit owner password.
- Owner can inhibit autopatch or repeater, enable either open- or closed-access for repeater or autopatch, and enable toll calls, reverse patch, kerkchunk filter, site alarm, aux rcvr, and other options, including two auxiliary external circuits.
- The cwid message, dtmf command codes, and owner-specified default parameters for cor and cwid timers and tones are burned into the eeprom at the factory.
- Cw speed and tone, courtesy beep and tail timers, and courtesy beep type can all be changed at any time by owner-password-protected dtmf commands.
- Auxiliary receiver input for independent control or cross linking repeaters.
- Many built-in diagnostic & testing functions using microprocessor.
- Color coded led's indicate status of all major functions.
- Welded partitions for exciter, pa, receiver, and controller. PEM nuts hold covers.
- 3-1/2 inch aluminum rack panel, finished in eggshell white and black.

HIGH PERFORMANCE XMTRS & RCVRS FOR REPEATERS, AF & DIGITAL LINKS, TELEMETRY, ETC.

FM EXCITERS: 2W continuous duty. TCXO & xtal oven options. FCC type accepted for com'l high band & uhf.

- TA51: 143-174, 213-233 MHz ...kit \$109, w/t \$189.
- TA451: 420-475 MHz ...kit \$109, w/t \$189.
- TA901: 902-928 MHz, (0.5W out); w/t \$219.

VHF & UHF AMPLIFIERS.

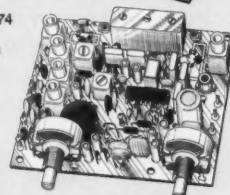
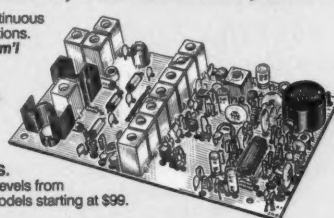
For fm, ssb, atv. Output levels from 10W to 100W. Several models starting at \$99.

FM RECEIVERS:

- R144/R220 FM RECEIVERS for 143-174 or 213-233 MHz. GaAs FET front end, 0.15uV sensitivity! Both crystal & ceramic if filters plus helical resonator front end for exceptional selectivity: >100dB at ±12kHz (best available anywhere!)

- Flutter-proof hysteresis squelch; afc tracks drift.kit \$149, w/t \$219.
- R451 FM RCVR, for 420-475 MHz. Similar to above.kit \$149, w/t \$219.
- R901 FM RCVR, for 902-928MHz. Triple-conversion, GaAs FET front end. ...\$169, w/t \$249.

- R76 ECONOMY FM RCVR for 28-30, 50-54, 73-76, 143-174, 213-233 MHz, w/o helical res or afc.Kits \$129, w/t \$219.
- R137 WEATHER SATELLITE RCVR for 137 MHz. Kit \$129, w/t \$219.



- For complete info, call or write for free catalog. Send \$2 for overseas air mail. For casual interest (U.S. only), check reader service; allow 3-4 weeks.
- Order by mail, fax, or phone (9-12, 1-5 eastern time).
- Min. \$5 S&H charge for first pound plus add'l weight & insurance.
- Use VISA, Mastercard, check, or UPS C.O.D. (\$5fee).

CIRCLE 57 ON READER SERVICE CARD

OUR 30TH YEAR!

hamtronics, inc.

65 MOUL RD. - HILTON NY 14468-9535

Phone 716-392-9430 - FAX 716-392-9420

Number 13 on your Feedback card HAM HELP

We are happy to provide Ham Help listings free on a space available basis. To make our job easier and to ensure that your listing is correct, please type or print your request clearly, double spaced, on a full (8 1/2" x 11") sheet of paper. You may also upload a listing as E-mail to Sysop to the 73 BBS Special Events Message Area #11. (2400 baud, 8 data bits, no parity, 1 stop bit. (603) 924-9343). Please indicate if it is for publication. Use upper- and lower-case letters where appropriate. Also, print numbers carefully—a 1, for example, can be misread as the letters l or i, or even the number 7. Specifically mention that your message is for the Ham Help Column. Please remember to acknowledge responses to your requests. Thank you for your cooperation.

Needed: Manual for Heath Kit LG-1 generator; also schematic/manual for a Lafayette LA-950 stereo amp. Copies are fine. I will pay. Buz Chadwick N4GTx, PO Box 1381, Palatine IL 60078. Tel. (708) 359-3603.

I am trying to locate either owners manual or schematic for Regency HR-2A 2 meter transceiver. I will pay to copy, or will copy and return. Ted Webb AC4CS, 118 Seabury Dr., Greenville SC 29615.

I need information on replacement parts for a Heath IM-28 VTVM that was modified to a TRVM. The Heath part numbers are: 150-57 TR1002 SS diode which is a replacement for a 6AL5, and 150-58 TR1119 SS triode which replaces a 12AU7. These are called FETTRONS or HINS. Any help in locating these parts, or specification sheets on any FETTRONS would be appreciated. The other FETTRONS I have are TR1006, TR1008, TR1010, TR1157, and TR1126A. Bob Juranek, 11469 Haggerty, Plymouth MI 48170-4455. Tel. (313) 459-7718.

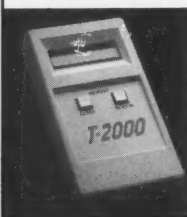
I would like to get in touch with hams who have experience with Yaesu CAT programming, particularly with the FT-232 connected to an FT-75/GXII and using some form of BASIC lan-

guage on an IBM PC compatible machine. Bill Schwiegeraht N8KSG, 1576 Karahl Drive, Cincinnati OH 45240. (513) 247-4561 days; (513) 851-9698 evas., collect; FAX (513) 247-4561, or e-mail for Prodigy user ID # BHKD13A.

I would like to contact former students of Nathaniel Narbonne High School (ex WB6RTO) in Harbor City CA, who got their novice license between 1965 and 1976. We are going to have a reunion! Marv Fagenson K6HCJ, 2100 Sawelle Blvd. Ste. 202, Los Angeles CA 90025. Tel. (310) 478-1777. Thank you.

Wanted: Genuine Hayes Modem 1200, model with 10 dip switches. Please write to William Petrisko, PO Box 42376, Tucson AZ 85733 or e-mail petrisko@evax2. engr.arizona.edu. Thanks.

TOUCH TONE DECODER:



T-2000

**SURVEILLANCE/
COUNTERSURVEILLANCE**
catalog \$5.

Decodes DTMF tones from audio source, (tape, phone, radio). Displays numbers on LCD display, 200 Digit memory. \$169 ppd. USA

EMCOM

10 HOWARD ST., BUFFALO, NY 14206
(716) 852-3711

SAY YOU SAW IT IN 73!



JOIN AMSAT

Support the Amateur Space Program

AMSAT Has Established Amateur Radio As a Permanent Resident in Space!

From operating any of 12 Amateur satellites circling the globe today to participating in Amateur Radio activities from the Space Shuttle, the benefits of space based Amateur Radio are available to you by becoming an AMSAT member. Our volunteers design, build and launch state-of-the-art satellites for use by Radio Amateurs the world over. We provide educational programs that teach our young people about space and Amateur Radio. Most of all, we provide our members with an impressive array of member benefits including:

- Operating aides such as discounted tracking software and land line BBS.
- An extensive network of volunteers to provide you local technical assistance.
- The AMSAT Journal, your bi-monthly periodical devoted to the Amateur Space program.

It's Fun! It's Easy! It's Exciting!

JOIN TODAY. For more information, call or write for your free information packet. Or send your dues now, check or charge: \$30 U.S., \$36 Canada/Mexico, \$45 all else. (\$15 towards the AMSAT journal.)

AMSAT, P. O. Box 27, Washington, D.C. 20044

(301) 589-6062; Fax: (301) 608-3410

TWO METER SPECIAL

MOT MICOR ACC:
8F CABLE \$ 9.00 2FSCAN \$ 5.00
SPEAKER \$ 7.00 4FHEAD, 4FSCAN \$12.00
MICS \$10.00
GE EXEC II: 138-155 MHz, 40 WATT, DRAWER UNIT ONLY, \$45.00 EACH:
WITH ACC, \$115.00 EACH.
GE EXEC II: 42-50 MHz, 50 WATT, DRAWER UNIT ONLY, \$85.00 EACH:
WITH ACC, GROUP: \$110.00
PORTABLES, STANDARD HX-300, ZCHAN, 132-144 MHz \$75.00 EACH.
50-MOT MICORS T74RTA 3803ASP11—ALL ACC. AS IS \$165.00 EACH.
80 Standard Series, 300 Portable with chargers. 139-150 MHz ... \$115.00
MT 500 HB 150-160, 4F TONE, 1 SET ELEMENTS, AS IS \$90.00

CALL OR WRITE FOR CURRENT FLYER.

ALL SALES "CASH" OR "CERTIFIED FUNDS" SHIPPED BY UPS.

C.W. WOLFE COMMUNICATIONS, INC.

1113 Central Avenue
Billings, Montana 59102

★ FAX ★ FAX ★
(406) 252-9617

★ TELEPHONE ★ TELEPHONE ★
(406) 252-9220

CIRCLE 20 ON READER SERVICE CARD

SPY ON THE EARTH

See on your computer screen what 6 or more U.S., Russian and Japanese satellites see. Make money many ways. Makes a terrific science project. We manufacture and sell all the equipment you need. In business since 1956.

For complete details dial our electronic bulletin board anytime. 300-2400 baud. Modem configuration: 8 bits, 1 stop, no parity: (718)-740-3911. Voice 8AM-1PM: (718)-468-2720.

Or send \$20 for fantastic 8 disk program set for your IBM-PC.

Vanguard Labs

196-23 Jamaica Ave., Hollis NY 11423

NOW—NO CODE!

The Ham Radio Handbook by Don Stoner gets rave reviews as the best training aid to help you earn the no-code ham license. Over 200 pages, packed with information—all the test questions, correct answers and the theory behind the questions. Only \$9.95 (\$2.00 S&H).

YOU CAN PASS THE CODELESS HAM RADIO TEST AND WE GUARANTEE IT!

It's easy and fun with the **NARA Education Package**. You get Don Stoner's **Ham Radio Handbook**, IBM or Macintosh compatible software to test your knowledge after you have studied the book; an extensive list of Volunteer Examiners you can contact, the **FCC Rules and Regulations** for ham radio, a copy of **Amateur Radio King of Hobbies**, plus a bonus copy of our journal, **The Amateur Radio Communicator**, by mail. The **NARA Education Package** is only \$29.95 for the IBM or \$49.95 for the Mac version (\$3.00 S&H).

Join NARA today and enjoy the exciting world of ham radio—and beginners don't need to know the code! A one-year **NARA** membership & subscription to **The Amateur Radio Communicator** is only \$10.00.



NARA

NATIONAL AMATEUR RADIO ASSOCIATION

CALL US TODAY!!

P.O. Box 598, Redmond, WA 98073
Orders Only 1-800-GOT-2-HAM
Inquiries (206) 869-8052

CIRCLE 223 ON READER SERVICE CARD

Amateur Radio Via Satellite

Andy MacAllister WA5ZIB
14714 Knightsway Drive
Houston TX 77083

Korean Star Rising

In late July a new amateur-radio satellite is scheduled for launch from Kourou, French Guiana. If all goes well, the satellite, KITSAT-A, will become an OSCAR (Orbiting Satellite Carrying Amateur Radio). The satellite builders in England have announced further payload details since the brief system description presented in the April 1992 "Hamsats" column.

The University of Surrey in England teamed up with the Korean Advanced Institute of Technology (KAIST) in 1990 to begin a joint educational effort to build a satellite adhering to the IARU (International Amateur Radio Union) definition of an amateur-radio satellite. The project has progressed rapidly through the cooperative efforts of the experienced UoSAT engineers and the KAIST student-engineers. KITSAT offers all the qualities built into UoSAT-OSCAR-14 and 22, but with some new and exciting features.

Current Technology

KITSAT-A carries a packet communications system with a digital store-and-forward unit like its predecessors, but with 13 megabytes of memory. Due to the availability of mature high-speed communications software, KITSAT will go to orbit ready for operation by any station currently active via U-O-22. Over the more populated parts of the world, U-O-22 has been full to capacity with user file transfers. The 9600 bps (bits-per-second) format of

U-O-22 activity has performed very well and will be continued with the new satellite.

U-O-22's Earth Imaging System has proved quite functional and popular. Pictures of the Persian Gulf area during the Kuwait war clearly showed plumes of smoke from the burning oil-well fires. KITSAT carries a similar camera system. The basic CCD (charge-coupled device) unit has a resolution of four kilometers.

KITSAT Advances

Higher data speeds are possible with KITSAT. Although the main system is designed for 9600 bps, experiments are planned using digital signal processing up to 38,400 bps. KITSAT Project Manager Jeff Ward GØ/K8KA is enthusiastic about the incorporation of very-high-speed data communications through an amateur satellite, but is most intrigued by the new imaging equipment.

One of the most exciting additions to KITSAT is a second CCD camera with a telephoto lens assembly. It provides up to a 400 meter resolution. This level of definition allows identification of man-made structures from space. The wide-angle camera can be used to spot areas of interest while the telephoto system can zoom in on the target area.

The cameras are just one part of the complete Earth Imaging System (EIS). Both CCD units are connected to a Transputer Image Processing Experiment (TIPE). Manipulation of the image data can be performed in orbit prior to transmission to earth without heavy reliance on other comput-

ing resources on the spacecraft.

KITSAT carries a Digital Signal Processing Experiment to be used for speech synthesis, store-and-forward voice messages, and high-speed data modulation and demodulation.

Hamsat satellite telemetry has been sent by voice synthesizers listing numeric sequences for over a decade, beginning with UoSAT-OSCAR-9. Simple words and phrases have also been possible. The KITSAT system is capable of multilingual messages. The speech system is limited only by the imagination of the programmers.

The Korean Amateur Radio League is working in conjunction with KAIST to develop simple, dedicated handheld receivers for KITSAT reception. Plans are to distribute these inexpensive 70cm units to schools. Messages of all types will be loaded into the satellite's memory for broadcast to amateur radio operators, experimenters and educational institutes.

Other experiments with the voice message forwarding potential of the system have not been defined but will begin when the satellite is in orbit. Real-time conversion of a digital uplink signal to an FM voice downlink for repeater style operation is a possibility.

AMSAT-OSCAR-10 and Fuji-OSCAR-12 were both severely affected by radiation damage. Amateur-radio satellite designers are increasingly interested in studies of the effects of radiation on all types on electronic circuits. Radiation detection experiments have been flown on previous amateur satellites, but at low altitudes.

KITSAT carries a Cosmic Ray Experiment (CRE) to measure total radiation dose encountered by the spacecraft and to detect highly-energetic cosmic rays. All the satellite's onboard systems, including the computers, power systems, memories and solar cells, will be monitored.

Phase-3-D, the current high-or-

bit satellite under construction, will encounter radiation levels similar to those seen by KITSAT. Information obtained from the KITSAT measurements will be extremely useful to Phase-3-D designers. Data formats will be available from the KARL, KAIST and the University of Surrey via AMSAT-UK.

The primary payload traveling with KITSAT is an oceanographic satellite, *Topex/Poseidon*. A microsatellite, S80-T, will also go up on the same late-July flight of *Ariane V-52*. The anticipated orbit is circular with an altitude of 1330 kilometers and a 66-degree inclination. No other OSCAR has been placed in such an orbit.

The inclination, or angle of the orbital plane with respect to the equatorial plane (equator), for KITSAT is not as high as other low-earth-orbit hamsats. Most are in polar orbits with inclinations of at least 80 degrees (90 degrees would be directly over the poles). KITSAT's inclination is also not as low as a high-inclination shuttle orbit (typically 57 degrees). The result of the 66-degree inclination will be noticed by those in high latitudes since the orbit will have characteristics similar to the shuttle, but at a much higher elevation.

An altitude of 1330 kilometers is similar to that of AMSAT-OSCAR-7, which is currently circling the earth near 1460 kilometers. For those who were active via A-O-7 in the '70s, antenna pointing was relatively easy and passes lasted long enough to make several contacts. DX was even possible from south Texas to parts of Western Europe. RS-10/11 is near 1,000 kilometers, while the current microsats and UoSAT-OSCAR-11 are even lower. KITSAT's orbit will provide users with longer access times and slower apparent Doppler-shift-to-signal frequencies.

Communications Via KITSAT

Operation via KITSAT will be easy for those already on U-O-22. The satellite's frequencies are shown in Table 1. KITSAT transmits and receives 9600 bps FSK using the AX.25 protocol. The programs currently available of U-O-22 access will allow telemetry files, experiment data, picture files from the cameras and user-uploaded files and messages to be downloaded.

Sources at the University of Surrey anticipate that 95 percent of the satellite's operating time will be devoted to normal 9600 bps communications. The rest of the time will be used for experiments with voice, higher-speed data and other DSP activities.

KAIST earth station HLØENJ in South Korea will manage KITSAT's activities, while the University of Surrey in England will provide advice as needed. Current plans focus on operating KITSAT as a satellite dedicated to the amateur radio satellite service. Exciting times are on the horizon for the first hamsat sponsored by South Korea.

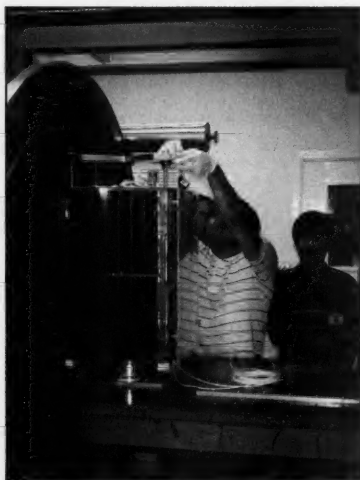


Photo A. The KITSAT-A microsatellite enters thermal-vacuum testing (5/11/1992). H.S. Chang removes the lifting frame as H.S. Kim looks on. Photo by J.W. Ward GØ/K8KA.



Photo B. The KITSAT-A logo.

Table 1. KITSAT-A Frequency Chart

UPLINKS:	145.850 MHz	Primary access channel
	145.900 MHz	Secondary access channel
DOWNLINK:	435.175 MHz	

HOMING IN

Number 15 on your Feedback card

Joe Moell, P.E., K0OV
PO Box 2508
Fullerton CA 92633

RDF Opportunities Abroad and at Home

Enhancing international good will and advancing communications and technical skills are two of the five purposes of amateur radio. We all know that because it says so in the beginning of FCC Part 97. Radio Direction Finding (RDF) competitions are a perfect way for hams to do both and have a barrel of fun at the same time.

As I write this, it has been a month since this column broke the news of an invitation for U.S. foxhunters to participate in the Ukrainian RDF Championships in September (see "Homing In" for April 1992). I am astonished at the small response so far.

John Douglas N0ISL, Technical Director of the Foundation for Amateur International Radio Services (FAIRS), reports only a trickle of inquiries so far. One of the respondents is of Ukrainian descent, intrigued with the program mostly because of the opportunity to visit his homeland.

Why haven't hams jumped at the chance to take part in an adventure like this? John suspects that some may fear the political situation in that part of the world. He points out that unrest is severe in Armenia, Georgia, Moldavia, and Azerbaijan, but not in

the Ukraine and central Russia. Besides, your hosts will be taking good care of you.

"It was almost amusing the way we were guarded and herded on our last trip," John says. "There's always the risk of some sleazy guy sliding up to you on the street and saying, 'Do you want to buy some rubles?' But you can see him coming half a block away. As one would start to approach, about six very loud Russian hams would be between me and him, and he would be gone." Instead of the tourist hotels, RDFers are invited to stay in Ukrainian hams' homes. You won't be sampling night life in the evening. Instead, you will probably be at someone's ham station, working the world.

"Lvov is a very European city, 40 miles from the Polish border," John says. "The best way to get there is to fly to Moscow, then take the overnight train for the 700-mile trip to Lvov. Travel on the train is an absolute joy. You see the countryside from European style coaches with tables and a matronly old lady who insists that you drink all the tea you can. The people are as warm and sharing as any I have ever known."

Soviet hams are just as innovative as hams anywhere else, but they lack many of the resources we take for granted. If you think getting parts for your do-it-yourself ham gizmos is hard, imagine the plight of hams in former iron-curtain countries.

John tells of his experiences on the train, meeting foxhunt organizer Igor Shewchuk UB5SBD. "He brought some hand-built foxes that he was working on, which also did the scoring and offloaded via 2 meters all of the competitors' check-in times (Photo A). It had an optical reader and he was hand-manufacturing all the little optical cards. He wanted me to look at it, suggest some changes and see if I could get him some parts." Time is getting short to make arrangements for this event. UB5SBD says, "You Americans don't have to send your champions. We'd love to show it to anyone who is interested."

If you think you're ready for a world-class foxhunt, and you think you would make a good ham ambassador, write to N0ISL at 19164-147th Street NW, Elk River MN 55330.



Photo B. Radio foxhunting has long been a popular children's sport in Europe and Asia, but nowhere more than in the former Soviet Union, where it was sponsored by the military and taught in the schools.

East and West—Different Styles

It is clear to me that there would be more interest in the Lvov opportunity if there were more similarity between RDF contesting in the USA and foxhunting in the rest of the world. European and Asian hunts are all on foot, with multiple transmitters on a course that covers several kilometers. Unless you are in great physical condition, you're doomed to an embarrassing rear-guard finish in these sprints.

While there are several age categories, international foxhunting is primarily a sport for young boys and girls (Photo B). The primary purpose is to teach and reward physical conditioning and orienteering skills, with radio/electronics proficiency as a secondary aspect. The vast majority of European contestants are not licensed hams.

Here in the USA, hams don't think of transmitter chasing as a body building activity. We go T-hunting for a social experience or for a technical challenge. Unlike elsewhere in the world, we have the additional freedom to use our RDF skills for self-policing or to aid in volunteer search and rescue. It is an activity for ham clubs, not youth groups.

By not having the opportunity to participate in radiosports, young people in the USA are missing out on a good thing. Over the years, other international sports (like soccer) have found their way into our schools, so why not foxhunting?

Perhaps some of you readers are in a position to help make this happen. If you are a teacher who is including ham radio in your curriculum (Bless you!), consider adding foxhunting to the activities. No more classroom time available? How about putting it into your school's physical education program? I would have enjoyed foxhunting more

than any other activity we did in phys. ed. when I was a kid.

Are you into orienteering? There are so many similarities that orienteers should feel right at home on a foxhunt course. I'd like to hear from people who can tell me how to get orienteers and foxhunters together.

N0ISL would like to see two-way exchanges with UA-land foxhunters. "We could invite a young Russian or Ukrainian here with his RDF gear and have him teach it to clubs or interested groups," he says. "If three ham clubs picked up the cost of getting one here, and split the housing for a couple of days each, we're talking about a very small budget."

What are your thoughts? Write me at the address above. I try to answer the mail promptly. (Hint: Letters including self-addressed stamped envelopes go to the top of the pile.) You can also catch me on CompuServe (75236,2165) or Internet (JoeMoell@cup.portal.com).

Turning to Technical Topics . . .

At the end of a mobile T-hunt, you often have to get out of your car and beat the bushes. That part of the hunt is called the "sniff." Sniffing your way to a concealed 146 MHz transmitter is tricky if all you have is a 2 meter handheld rig.

The "body shield" sniffing technique loses its effectiveness as you approach a high-powered T because you can't attenuate the signal enough to determine direction and level changes. You can try tuning 5 or 10 kHz off frequency to knock down the signal, but the effectiveness of that play depends greatly on the modulation characteristics of the fox's signal.

You can build special sniffing gear, such as field-strength meters and du-

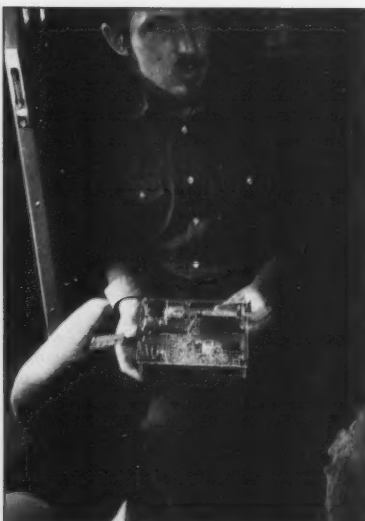


Photo A. Igor Shewchuk UB5SBD shows off his computer-controlled fox-box on the train ride to Lvov. Hunters check in by inserting an optical card into a reader, which records competitors' times and transmits this data via radio link to the judges. (Photo by N0ISL)



Photo C. Quads for 440 MHz are compact and highly directional. This is a commercial model made by Alabama Amateur Electronics, modified for mast connection at the center of gravity, with a ferrite balun added.

al-antenna RDF sets. But the handheld would be good enough if you could just get the hider to reduce power by 60 dB as you get within striking range. If you have a dual-band (2 meter and 70 centimeter) HT, you can get the same effect by sniffing the third harmonic.

FCC rule 97.307(e) limits the allowable harmonic power of 2 meter transmitters. If the hidden T runs less than 25 watts, each harmonic may not exceed 25 microwatts. If you think that's too puny for sniffing, think again.

"Every 2 meter transmitter I've hunted has put out enough third harmonic to make it sniffable once I'm in walking range," says Martin Hasa KB6MAH, who has used this trick for some time.

Not only does switching to the third harmonic give you instant attenuation, it also allows you to use a smaller, highly directional antenna for the sniff. Elements on a 70cm quad are only 6-1/2 inches on a side. The quad shown in Photo C has a boom length of 21 inches. You can carry it with the attached mast as shown, or eliminate the mast and just hold it by the rear of the boom.

Many scanners receive the 70cm band, but most don't have S-meters, so it's harder to get good bearings with them. A dual-band HT modified for extended receiver frequency range (to go below 440 MHz when the T-hunt is on 146.665 or below) is ideal.

(Here is an "electronic countermeasures" hint for hiders: If you think hunters will be sniffing on your third harmonic, use the maximum legal level of deviation. If you run +/- 5 kHz deviation on 2 meters, your 70cm harmonic will deviate +/- 15 kHz, exceeding the passband width of most UHF receivers. They will still be able to hunt you, but it will be more difficult.)

Pattern Perfection

Quads for 70cm are an easy homebrew project, or you can buy one ready to go. Not only are they fine for harmonic sniffing, but they are used in

my area for mobile hunts on 446 MHz FM.

Note in the photo the non-metallic (PVC pipe) mast and tee couplings I use to preserve the quad's directional pattern. There are two tee fittings fastened to the boom, one for vertical polarization and the other for horizontal. The hider is allowed to use either polarization, so quick changing is important.

The directional pattern of a quad is never perfect. Unwanted side lobes and back lobes can show up for a number of reasons. One common cause is signal pickup by the shield of the feed line. A balun at the feed point eliminates the problem, but typical sleeve baluns, called "bazookas," are frequency-sensitive and their dimensions are critical at UHF.

I solved a pesky sidelobe problem on this quad by using ferrite beads as a choke balun. It takes two dozen beads (4-1/2 inch balun) to insure that all outside shield RF currents are attenuated to insignificant levels. You can use this trick on any VHF or UHF beam, but be sure to pick the right ferrite material.

At 2 meters, #43 beads (part number FB-43-2401) are optimum. That mix is usable from 6 meters well into the UHF range. A better material for use above 400 MHz would be #64, but #64 beads of this size are not available.

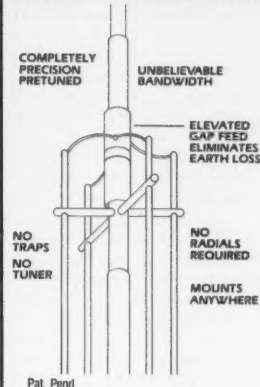
Cut the coax jacket back and slip the beads over the shield braid before installing the end connector. The inner diameter of the beads (0.197 inch) is too small to put them over the jacket. Put tape or shrink sleeving over the whole balun if you like, but don't worry about shorting anything with the beads. Ferrites for these frequencies are non-conductive.

My source for beads is Amidon Associates, PO Box 956, Torrance CA 90508; (310) 763-5770. The cost is \$4.50 per dozen or \$16 per hundred. There is no minimum order quantity, but Amidon charges at least \$4 per order for shipping and handling.

THE ANSWER IS GAP TECHNOLOGY • THE ANSWER IS GAP TECHNOLOGY

Q An Antenna for limited space that doesn't limit my ability?

A Yes...the answer is GAP's revolutionary new Eagle.



If you're looking for an antenna that can outperform the others and give you the edge, you're looking for a GAP. The Eagle DX-VI is the newest offering from the people who revolutionized antenna design, eliminated earth loss and put your power where it counts. The new Eagle answers your toughest demands — for optimum efficiency in tight places. Ground, pole, roof or tower mount. Put it up. Turn it on. No tuning. No frustration. GAP delivers everything but the hassles. And — GAP delivers at a fraction of the cost of the "so-called" competition.

The Eagle DX-VI
40m 20m 17m 15m 12m 10m

\$239
plus shipping

All out efficiency.
All out performance.
GAP gets it all out.



6010 Bldg. B
N. Old Dixie Hwy.
Vero Beach, FL 32967

(407) 778-3728
Commercial Inquiries Invited

THE ANSWER IS GAP TECHNOLOGY • THE ANSWER IS GAP TECHNOLOGY

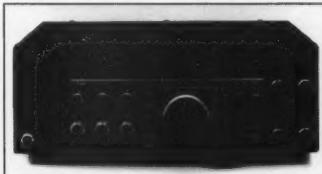
CONTACT ADVERTISER DIRECTLY

TALK WITH THE KNOWLEDGEABLE PEOPLE AT

QUEMENT

ELECTRONICS

FEATURING AN EXTENSIVE LINE OF ICOM PRODUCTS



**ALL MODE HF
BASE STATION**
\$2399⁰⁰

#IC-765



• IC-12 GAT	1.2 GHZ HT	\$324.00
• IC-R1	WIDEBAND RECEIVER	\$519.00
• IC-R100	WIDEBAND RECEIVER	\$599.00
• IC-735	ALL MODE HF TRANSCEIVER	\$899.00
• IC-725	ALL MODE HF TRANSCEIVER	\$799.00
• IC-3SAT	220 MHZ HT	\$319.00
• IC-726	ALL MODE HF TRANSCEIVER	\$1089.00



**1000 S. BASCOM AVENUE
SAN JOSE, CA 95128**

Call us at (408) 998-5900

Since 1933

CIRCLE 132 ON READER SERVICE CARD

73 Amateur Radio Today • July, 1992 55

Ham Television

Bill Brown WB8ELK
c/o 73 Magazine
70 Route 202 North
Peterborough NH 03458

Monster ATV Rockets

Just north of Edwards Air Force Base in the Mojave Desert, I cruised along the edge of a large dry lake bed. At the end of a little-travelled dirt road, I drove past the liquid fuel rocket engine test stand and parked next to a Quonset hut where a number of folks were assembling the solid fuel rocket.

A NASA experiment in progress? Nope... I had just arrived at the "Missile Test Area" for the Reaction Research Society. This group consists of a number of experimental rocketeers who meet periodically in the desert to test out their new creations. We're definitely not talking about your typical hobby store variety of model rocket—some of their rockets are what I would consider full-scale!

The ATV Rocket

Inside the Quonset hut, Bruce Markle of San Diego was busy assembling his 6-foot-tall solid-fuel rocket. Bruce's rocket had a very intriguing tail-fin assembly. To stabilize the rocket from rolling during the flight, he had "rollerons" mounted in two of the fins. Similar to the devices used in Sidewinder missiles, each rolleron consisted of a 2-3/4" milling wheel (available from machine tool shops) which was mounted vertically within a hinged surface in two of the tail fins. The edge of each wheel is grooved in much the same way as a water wheel. This allowed Bruce to spin up each rolleron with compressed air to several

thousand RPM before liftoff. In addition, the rollerons would continue spinning as the rocket flew through the air at high speeds. During flight, if the rocket attempted to roll, the rolleron-fitted fin would compensate due to gyroscopic action.

In addition, Bruce could move the other two fins (acting as one surface) via R/C control to actually steer the rocket during the flight.

Since Bruce's rocket was over 4" in diameter with a large payload compartment, and since it was so incredibly stable, it seemed to be the logical vehicle for some live ATV experiments!

Mike Henkoski KC6CCC teamed up with Bruce and built a very compact 6-watt ATV transmitter/camera package designed to fit snugly within the rocket. The payload consisted of a PC Electronics ATVM-70 micro-ATV transmitter (see the July '91 issue of 73, page 9), a 6-watt amplifier brick and a miniature B/W TV camera (similar to the Micro Video Products CX-102 or the GBC CCD-100). Mike mounted everything in a Bud box and PC board material reinforced with brass strips. Mike's package was so well made, it looked like you could drive a truck over it with no ill effects!

Just outside of the camera porthole, a small mirror was epoxied in place to direct the camera view towards the ground to see the spectacular liftoff. Right above the mirror, a half-wave dipole was mounted for the 434 MHz ATV downlink. The "V" shape of the dipole helped make it more aerodynamic and also improved the impedance match.

A Spectacular Liftoff

Just prior to liftoff, two jets of com-

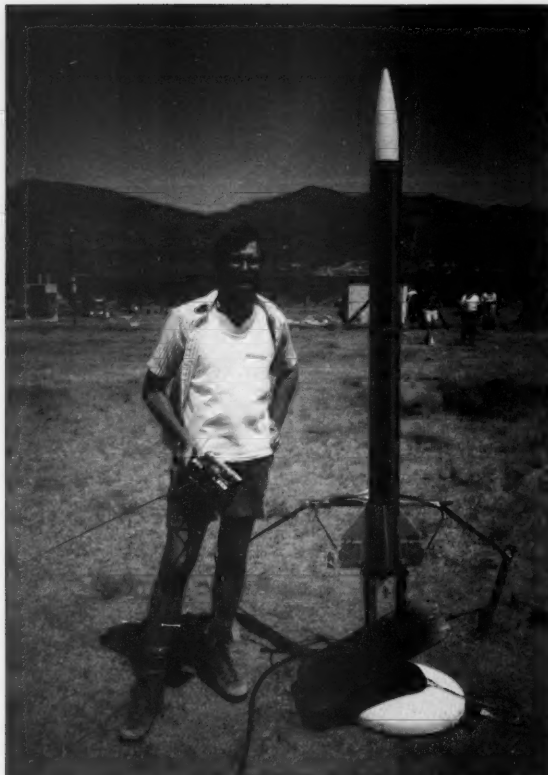


Photo A. Bruce Markle reads his R/C-controlled, ATV model rocket for flight.

pressed air spun up the rollerons to several thousand RPM. As we all kept our distance, the fire command was issued and, in an impressive display of smoke and flame, the rocket raced for the sky. Inside the hut, we could all ride along with the rocket by watching the ATV downlink. With the high-power ATV transmitter we received absolutely P-5 snow-free images throughout the flight. The rocket made it up to

about 1200 feet in just a few seconds. The rollerons worked amazingly well, absolutely NO spinning was observed in the video downlink, just a beautifully stable view of the desert floor disappearing below.

Splat!

As the parachute ejected, disaster struck! The elastic shock chord con-



Photo B. Liftoff of the ATV rocket.



Photo C. The "landing." The ATV package miraculously survives the impact amidst the remains of the rocket.



Photo D. Mike Henkoski KC6CCC (designer of the ATV package) pulls the ATV payload out of the rubble and is amazed to find it in perfect working order!

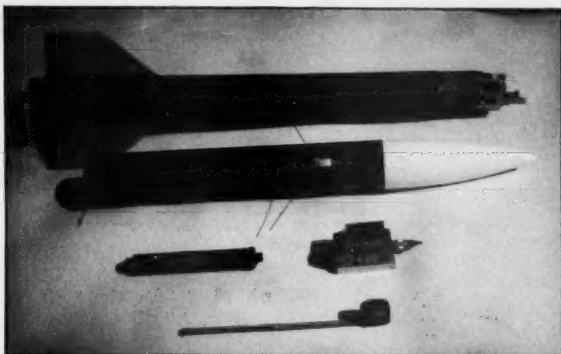


Photo E. Individual rocket sections. The ATV package (shown in the foreground next to the rocket engine) was mounted just below the nose cone section.

necting the parachute to the body of the rocket snapped in two and the rocket (with ATV payload) plummeted rapidly to the ground below. We all watched in stunned silence as the

rocket hit the ground with a sickening "whump" just 100 feet from the hut.

As the dust settled, all that remained of the rocket was the tail-fin assembly and a large pile of twisted

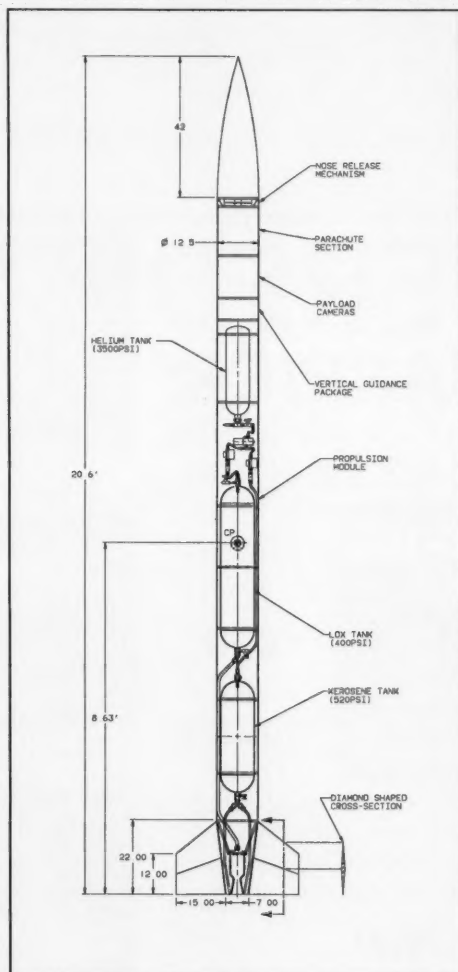


Figure 1. Diagram of David Crisalli's liquid fuel rocket which will take ATV to over 200,000 feet this fall.



Photo F. Close-up view of the small mirror which directed the camera view towards the ground. The ATV transmit antenna consisted of an inverted-V style dipole located just above the mirror.

rubble. We all wondered if any recognizable pieces of the ATV payload could be found. After digging around a bit, we found a few shards of electronic components: a bit of a resistor, a partial capacitor and a couple of rubber buttons. It turned out to be all that was left of a Radio Shack timer. At the bottom of the pile we were astonished to find the slightly bent, but completely intact ATV package. We were even more amazed when Mike KC6CCC applied power to the transmitter and we were treated with a perfect picture. It takes a REAL licking and keeps on ticking! We estimated that the rocket had hit the ground going over 150 mph and produced over 1000 Gs on the package during the impact.

Future Flights

Bruce Markle's rocket was a scale model of a liquid-fueled rocket that David Crisalli is currently building. In fact, this flight was a test to see how the guidance system and the ATV payload performed in order to prepare for the mega-flight later this fall.

David Crisalli's liquid fuel rocket will stand just under 20 feet high, will be 12.5" in diameter, and will weigh in at 380 pounds (see Figure 1). Using a mixture of kerosene and liquid oxygen, the engine can produce 1,000 pounds of thrust for upwards of 45 seconds. David hopes to reach a top altitude of over 200,000 feet with this flight (currently scheduled for early fall). He is hoping to gain permission

to fly out of the White Sands, New Mexico, area.

This rocket will have a fairly large payload area. Current plans are to fly the 6-watt ATV package with a B/W camera (and possibly a color camcorder) and a 2 meter telemetry downlink. The line-of-sight range at this altitude will exceed 550 miles. David has room for some additional payloads and would be happy to fly other packages as space permits.

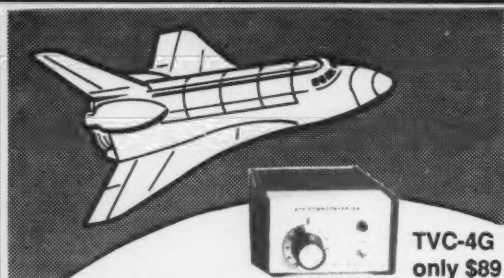
This flight should provide us with some very spectacular ATV footage during its trip to the very edge of space.

Join in the Fun

If you would like more information about the Reaction Research Society's activities, you can write to them at the following address (they also offer a newsletter): Reaction Research Society, P.O. Box 90306, World Way Postal Center, Los Angeles CA 90009. For more information about the liquid fuel rocket you can contact David Crisalli, 3439 Hamlin Ave, Simi Valley CA 93063. To learn more about the scale model version shown in this column you can write to Bruce Markle, 5944 Portobelo Court, San Diego CA 92124.

For those of you interested in building large rockets, there is a publication called "High-Power Rocketry" put out by the Tripoli Rocketry Association, Inc., P.O. Box 40475, St. Petersburg FL 33743-0475.

AMATEUR TELEVISION



TVC-4G
only \$89

SEE THE SPACE SHUTTLE VIDEO

Many ATV repeaters and individuals are retransmitting Space Shuttle Video & Audio from their TVRO's tuned to Satcom F2-R transponder 13. Others may be retransmitting weather radar during significant storms. If it is being done in your area on 70 CM - check page 413 in the 91-92 ARRL Repeater Directory or call us, ATV repeaters are springing up all over - all you need is one of the TVC-4G ATV 420-450 MHz downconverters, add any TV set to ch 2, 3 or 4 and a 70 CM antenna. We also have downconverters and antennas for the 900 and 1200 MHz amateur bands. In fact we are your one stop for all your ATV needs and info. Hams, call for our complete ATV catalog - antennas, transceivers, amplifiers. We ship most items within 24 hours after you call.

(818) 447-4565 m-f 8am-5:30pm pst.

Visa, MC, COD

P.C. ELECTRONICS

Tom (W6ORG)

2522-WG Paxson Ln Arcadia CA 91007

Maryann (WB6YSS)

UPDATES

Number 30 on your Feedback card

8,000 Channels for the Ramsey FX-146

See the above article in the June '92 issue of 73, page 10. Although the PC board foil pattern and the parts placement diagram are correct as shown, the schematic diagram (Figure 1) has three errors. The "+RPT" and the "-RPT" lines are reversed in the schematic and the value of the capacitor attached to the Vcc lead on the bottom EPROM should be changed from a 0.1 μ F value to 10 μ F. In addition, the program to determine the EPROM frequency select data is missing the "divide by" symbols in lines 70 and 90. Also, the values in lines 100, 110 and 120 have been changed in the new version. See the figure for the correct program. This pro-

gram is also available from the 73 BBS at (603) 924-9343 under the filename "FX146MOD.BAS." Cecil A. Moore KG7BK

Ask Kaboom

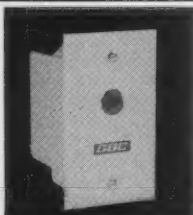
In the June '92 "Ask Kaboom" column the following sentence was inadvertently changed: "Instead of sending the same byte over and over, the delta modulator simply sends it once: analog with a code telling the demodulator how many times it is to repeat." The sentence should read: "Instead of sending the same byte over and over, the delta modulator simply sends it once, along with a code telling the demodulator how many times it is to repeat."

Michael Geier KB1UM

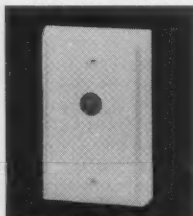
The BASIC program for obtaining the HEX address and HEX memory contents for the two EPROMs is listed below:

```
10 FOR N% = 7000 TO 9000
20 F = (20*N%)
30 FF=(F-140000)/10:FFF=FF
40 UFF=FFF MOD 10:FFF=FFF\10
50 TFF=FFF MOD 10:FFF=FFF\10
60 HFF=FFF MOD 10:FFF=FFF\10
70 ADDR=UFF\2+TFF\8+HFF\128+FFF\2048
80 PDATA=N% MOD 256
90 PHDATA=N%\256
100 IF F>145100 THEN IF F<145500 THEN PHDATA=PHDATA+128
110 IF F>146000 THEN IF F<147000 THEN PHDATA=PHDATA+128
120 IF F>147000 THEN IF F<147400 THEN PHDATA=PHDATA+64
130 PRINT "WORD", "NUMBER", "FROM ADDR", "HIGH BYTE", "LOW BYTE"
140 PRINT F,N%,4,HEX$(ADDR),"H",HEX$(PHDATA),"H",HEX$(PDATA),"H":PRINT
150 IF INKEY$="" THEN GOTO 150
160 NEXT N%
170 END
```

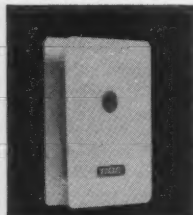
Figure. The updated program to determine EPROM frequency select data for the RAMSEY FX-146 modification.



IW-100 IN-WALL CAMERA
INSTALLS IN ANY SINGLE
GANG ELECTRICAL BOX!



SM-100 SURFACE CAMERA
CAN BE MOUNTED
ON ANY SURFACE!



CD-100 DOOR CAMERA
INSTALLS IN ANY DOOR!

WE HAVE SHATTERED THE PRICE BARRIER!

THEY HAVE ALWAYS BEEN GREAT CAMERAS,
NOW THEY HAVE GREAT PRICES, ALSO!

CCD-100



CAMERA HAS UNIQUE 1/4-20
MOUNT THAT ALLOWS IT TO BE
MOUNTED FROM ANY SIDE.



THE CCD-100 FAMILY

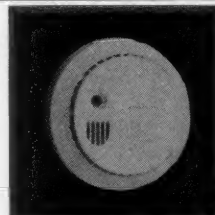
MINIATURE CCD
CAMERAS THAT
ELECTRONICALLY
COMPENSATE FOR ALL
LIGHT CONDITIONS!

PRICES
TOO
LOW
TO
PUBLISH!

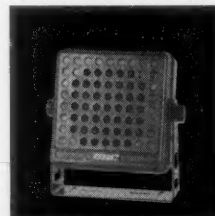
NO AUTO IRIS LENS NEEDED - USES VARIABLE
HIGH SPEED ELECTRONIC SHUTTER!
ALL CAMERAS COME STANDARD WITH A
BUILT IN 4MM F1.4 WIDE ANGLE LENS!

CCTV CORP

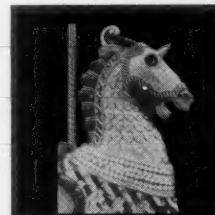
315 HUDSON STREET, NEW YORK, NY 10013
212-989-4433 • 800-221-2240 • FAX 212-463-9758 • TELEX 426471



SD-100 SMOKE DET. CAMERA
CAMERA IS BUILT INTO
A REAL SMOKE DETECTOR!



IS-100 SPEAKER CAMERA
AN OPERATING SPEAKER
WITH A BUILT IN CAMERA!



PC-100 PICTURE CAMERA
BUILT INTO A PICTURE!

Also
available
with a 2.5mm
Ultra Wide Angle
or a 6.5mm
Lens!

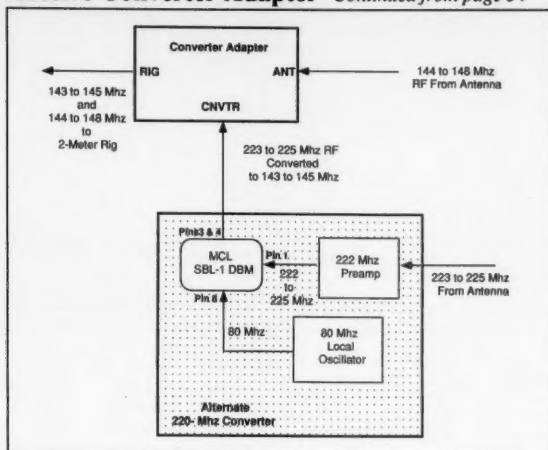


Figure 6. An alternative circuit for the 220 MHz converter using an 80 MHz local oscillator.

tally and L2 is mounted vertically in Figure 8A—though this could be reversed if you adjust the spacing and positioning of the mounting pads. The completed oscillator, preamp and mixer can be mounted in the same chassis with the Receive Converter Adapter or in a separate housing. I use threaded stand-offs to mount the modules in their enclosure.

Coax Section Trimming with a Grid-Dip Oscillator (GDO)

A Grid-Dip Oscillator (GDO), or solid-state equivalent, can be used to fine-tune the quarter- and half-wave coax sections. (Remember when most electronic devices had grids?) The first step is to create a small loop between the coax center conduc-

tor and shield at one end of the coax. Leave the other end of the coax open. Using a GDO coil selected to cover a range lower than the expected frequency, couple to the coax section loop and tune the GDO for a dip to indicate the resonant frequency of the line—moving higher in frequency until a dip is found. This is important in finding the true resonant frequency and avoiding false peaks. Trim the line by small cuts to obtain the desired resonant frequency. The same procedure can be used if you want to use the half-wave coax section, but the dip indicated will be at half the desired frequency. As an example, a properly trimmed half-wave coax section at 147 MHz will present a “dip” to the GDO at 147/2, or 73.5 MHz.

the unterminated quarter-wave section of coax $\pi/2$.) If possible, perform the initial checkout with a 50 ohm load to minimize the effects of an antenna SWR. Leaving the low-pass filter out during checkout may also be helpful. Transmit operation should be normal, with minimal differences noted from operation with the converter adapter out of the line to the antenna or dummy load. If abnormal operation such as reduced power out is indicated, check for correct converter adapter cable connections and check for coax section shorts. That’s all there is to it!

Operational Considerations

Power capability: The converter adapter has been used with transmitter outputs up to the 40-45 watts level. The RG-59/U cable can handle this power with no problem and the diodes have stood up well. At the other extreme, even operation at 100 mW should provide enough RF at the diodes to cause them to operate properly in this circuit.

Receive converter protection: Diodes D1 and D2 provide protection to the receive converter during transmit. Even with the diodes conducting, some RF is present at the converter port. Rough measurements with an RF probe-VTVM combination have shown the RF level to be over 1 volt. This should not bother the output of most converters, especially not the DBM types described, but it is something to be aware of before trying this approach.

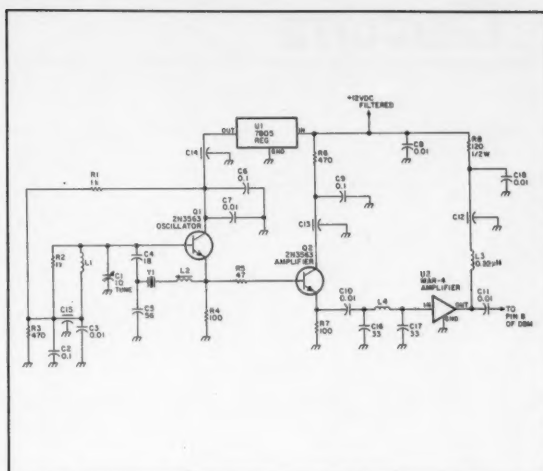


Figure 7. Schematic diagram of the local oscillator.

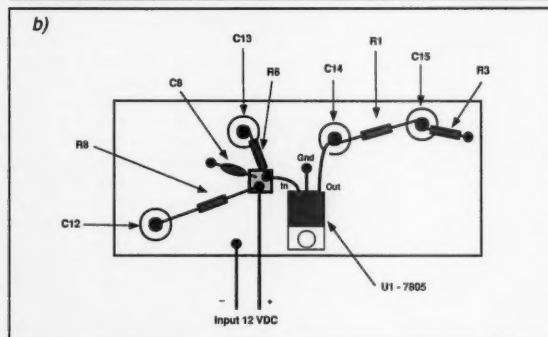
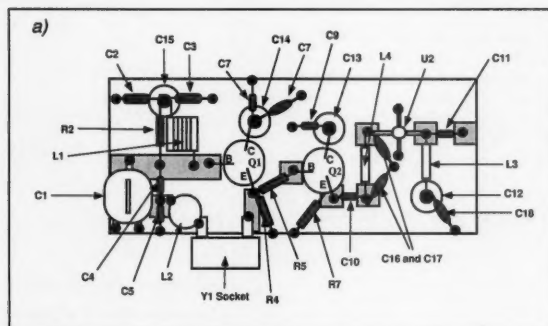


Figure 8 (a). Front side parts placement for the local oscillator. (b). Reverse side parts placement.

Checkout

With everything connected to the proper connectors on the converter adapter, start with your transceiver in the low power position. (It is important that the converter or another 50 ohm load is connected to the converter port during receive to minimize losses due to the reduction in signal which would result from

Parts List

C1	10 pF ceramic trimmer or equivalent
C2, C6	0.1 μ F disc ceramic capacitor, 16-20 volts
C3, C7, C8, C9, C10, C11	0.01 μ F disc ceramic capacitor, 16-20 volts
C4	18 pF NPO ceramic capacitor, 16-20 volts
C5	56 pF NPO ceramic capacitor, 16-20 volts
C12, C13, C14, C15	0.001 μ F feedthrough bypass capacitor, 16-20 volts
L1	5 turns no. 28 enameled wire, 0.1" l.d., 0.2" long
L2	8 turns no. 28 enameled wire, 0.1" l.d., 0.2" long on a slug-tuned form.
L3	0.22 to 1.6 μ H miniature RF choke
L4	0.10 μ H miniature RF choke
R1, R2	1,000 ohm 1/4 watt carbon film resistor
R3, R6	470 ohm 1/4 watt carbon film resistor
R4, R7	100 ohm 1/4 watt carbon film resistor
R5	47 ohm 1/4 watt carbon film resistor
R8	120 ohm 1/2 watt carbon film resistor
Q1, Q2	2N3563 NPN transistor or equivalent
U1	7805 or equivalent 5-volt regulator
U2	Mini-Circuits Lab MAR-4 MMIC amplifier
Y1	5th overtone, series-resonant crystal 90 MHz, 77 MHz, or 80 MHz (see text)
	DBM SBL-1 double-balanced mixer (Mini-Circuits Labs)

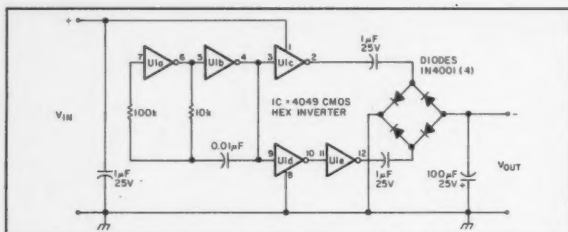


Figure 1.

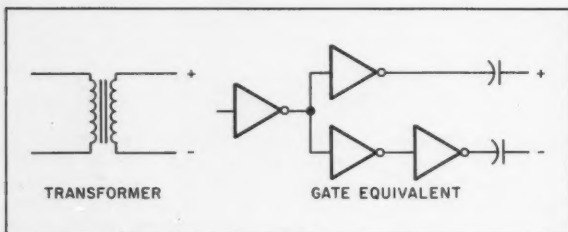


Figure 2.

Inverting Power Supply

How many times have you needed a low-current negative voltage for that op amp or RS-232 circuit? Figure 1 is a circuit I came up with to do the job. I used a 4049 CMOS hex inverter in this application since this IC is capable of more output current than the typical CMOS IC.

U1A and U1B form a standard CMOS oscillator. With the R/C values shown, the unit oscillates at 4200 Hz. U1C and U1D buffer the output of the oscillator, and U1E inverts the output to the diode bridge with respect to the output of U1C. The outputs of U1C and U1E are AC coupled to the diode bridge, then full-wave rectifies the AC signal and gives you the final negative voltage output.

Figure 2 shows how you can make a transformer equivalent circuit out of some

gates. In both cases you are AC coupled. And in both cases the outputs are 180 degrees out of phase with each other.

This circuit works well with low currents. With no load, the negative output is within 0.6 volts of the positive input. With 10 milliamps of load current, the negative output will be about 3 volts less than the positive input. The output is completely ripple-free with the 100 µF filter capacitor shown. Of course, at the 4200 Hz frequency the capacitor is almost equivalent to a 10,000 µF capacitor at 60 Hz.

Depending on current drain, this circuit is useful from 5 to 15 volts. Don't apply more than 15 volts input as you'll exceed the voltage rating of the 4049!

Phil Salas AD5X
Richardson TX

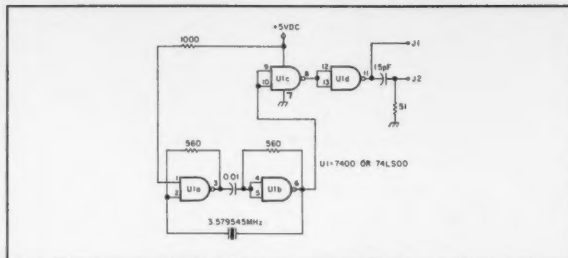


Figure 3. Wide-range crystal oscillator.

Wide-Range Crystal Oscillator for Receiver Sensitivity Testing

Here's a simple single-chip crystal oscillator which can use any crystal between 1 and 13 MHz and will produce very strong harmonics. When a color-burst crystal (3.579545 MHz) is installed, it will produce strong harmonics in or very near every HF band from 80 through 10 meters. These produce known "on-the-air" signals ideal for checking receiver sensitivity, noting the S-meter indication. If sensitivity is checked every six months any deviation will be readily evident, a warning that something in the RF path has deteriorated and should be investigated to maintain sensitivity within the manufacturer's specifications.

The crystal will oscillate in its series resonant mode in this circuit, a bit higher in frequency than that marked on the crystal. As an indication of the result to be expected, harmonics calculated from the marked frequency of the crystal, and the distance outside those ham bands not in exact harmonic relationship to the crystal fundamental frequency, are listed below, rounded off to the nearest kilohertz.

Whether the harmonic is in or slightly out of the band, sensitivity of the receiver will be the same because none of the out-of-band harmonics are more than a few parts per million from the nearest band edge. This is a very small percentage, even in the worst case condition of 30 meters where the third harmonic is 0.059% high.

No direct connection to the receiver is

required. If desired, the output can be connected through a step attenuator of 50 ohms impedance to the receiver antenna connector. However, unless this oscillator is completely shielded it will radiate strong harmonics to the station antenna.

As an example, feeding the output directly to the antenna connector on my Kenwood TS-440S/AT, the 8th harmonic on 10 meters registered S9 + 40 dB. Radiated about 50 feet to the nearest end of my 40 meter dipole, the 10 meter harmonic registered a little over S9.

Either a 7400 or 74LS00 chip can be used. There is approximately 3V peak-to-peak square wave riding on +1 VDC at J1. J2 provides a differentiated square wave—positive and negative pulses containing all harmonics—of about 0.25V peak-to-peak at 50 ohms impedance. A short "antenna" can be connected to J1 if desired to radiate the harmonics to your antenna.

All parts are available from Radio Shack as well as from most mail order parts dealers. The resistors are 1/4W, 5%; the capacitors are disc ceramic. The total cost will not exceed \$3.00, including the color burst crystal.

J. Frank Brumbaugh KB4ZGC
Bradenton FL

Band	Frequency	Deviation
80	3.580	
40	7.160	
30	10.740	590 kHz high
20	14.320	
17	17.900	168 kHz low
15	21.480	30 kHz high
12	25.060	61 kHz high
10	28.640	



PRINTED CIRCUIT BOARDS

It's easy to build PCB's. No camera or dark room are required. All materials, even 4 drills, along with simple instructions to use magazine or other types of artwork are included. All 6 4"x6" boards are precoated with a strong easy to use dry film photoresist. For **FREE** simple, step by step, instructions and catalog or to order the **CIRCUIT BOARD KIT** (\$45.00) call or write: Solder World, Dept. M4, 9555 Owensmouth Ave. #14, Chatsworth, CA 91311. (818) 998-0627 Fax (818) 709-2605

CIRCLE 156 ON READER SERVICE CARD

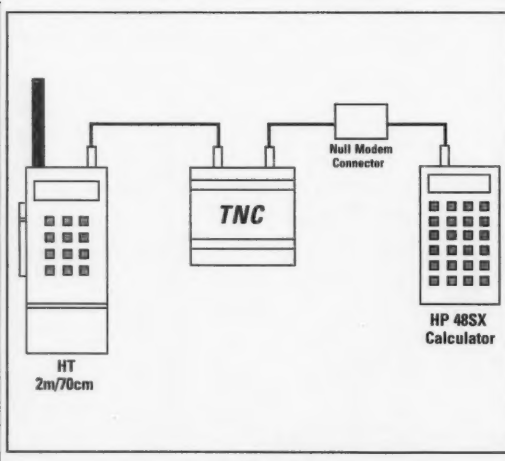


Figure 4.

Hand-Held Packet Station

This is one method of putting the HP48SX calculator to good use in the world of ham radio.

Here is the configuration I used for my packet station on Field Day, 22 June 1991. The HP48SX calculator runs a terminal emulation program, and is connected via its serial port to a TNC at 9600 baud. The HP48SX uses three "triple A" batteries, and I'm still using the batteries that came with the calculator (November 1990). The HP48SX has a 64 x 131 pixel display, and does quite well at displaying the data.

There are easier ways to enjoy packet radio, but I think this is the first time it has been done with a calculator.

It is fun, different, and very portable.

John Bachelor N8LJJ
Columbus OH

Courteous Service • Discount Prices • Fast Shipping
ALL ELECTRONICS CORP.
 Mail Order Electronic Parts And Supplies
 P.O. Box 567 • Van Nuys, CA 91408

Cigar Lighter Coil Cord



Automotive cigar lighter plug with replaceable 5 amp fuse. Quality, retractable coil cord extends to approximately 6 feet. Terminates with a 5 pin DIN plug which can be cut-off. Ideal for battery charger or running 12 Volt devices from car battery.

CAT# CLP-18 10 for \$12.50 **\$1.50 each**

VERY SPECIAL DEAL - 17 VDC 210 MA WALL TRANSFORMERS

New 17 Vdc, 210 ma wall transformers. 6 ft. cord. Unusual co-axial device on end of cord can be cut off and used for another application. Large quantity available.

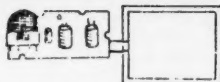
CAT# DCT-1721 100 for \$1.25 each **\$1.50 each**
 1000 for \$1.00 each

Piezo Element

3 Wire Piezo Element. Taiyo Yuden Co. #CB35BKR4. Self-excited piezo electric diaphragm 1.40" diameter x 0.021" thick. Resonant resistance: 400 ohms. 5" color-coded leads.

CAT# PE-12 10 for \$8.50 • 100 for \$65.00 **\$1.00 each**

Electroluminescent BACKLIGHTS



At last! A low cost electroluminescent glow strip and inverter. These brand-new units were designed to backlight small LCD TVs made by the Citizen Watch company. The inverter circuit changes 3 or 6 Vdc to approximately 100 Vac, the voltage required to light the glowstrip. Luminescent surface area is 1.7" X 2.25". The strip is a salmon color in its off state, and glows white when energized. The circuit board is 2.2" X 1". Glow strip and circuitry can be removed easily from plastic housing. Ideal for special lighting effects and antilighting. Citizen# 92TA operates on 3-6 Vdc.

LARGE QUANTITY AVAILABLE CAT# BLU-92 **\$3.50 each**
 10 for \$32.00 • 100 for \$275.00

ELECTRET MIKE

High efficiency, omni-directional, miniature electret condenser microphone element. Low current drain, good signal to noise ratio, operates on 2 to 10 Vdc. Ideal for telephones, tape recorders, noise-activated alarms and other applications. 0.39" dia X 0.31" high.

CAT# MIKE-10 200 pcs \$150.00 (75¢ each) **85¢ each**

TOLL FREE ORDER LINES

1-800-826-5432

CHARGE ORDERS to Visa, MasterCard or Discover

TERMS: Minimum order \$10.00. Shipping and handling for the 48 continental U.S.A. \$3.50 per order. All orders including AK, HI, PR or Canada must pay full shipping. All orders delivered in CALIFORNIA must include state sales tax (7.25%, 7.5%, 7.75%, 8.25%, 8.5%). Quantities limited. NO C.O.D. Prices subject to change w/out notice.

Call or Write For Our

FREE 64 Page Catalog
 (Outside The U.S.A. Send \$2.00 Postage)

ALL ELECTRONICS CORP.
 P.O. Box 567 • Van Nuys, CA • 91408

CIRCLE 194 ON READER SERVICE CARD

CB-TO-10 METERS

We specialize in CB radio modification plans and hardware. Frequency and FM conversion kits, repair books, plans, high-performance accessories. Thousands of satisfied customers since 1976! Catalog \$2.

CBC INTERNATIONAL

LOU FRANKLIN/KEHN - Owner
 P.O. BOX 31500X, PHOENIX, AZ 85046

Silent Solar Power



The \$349.00 Bullet-Tested QRV Solar Power Supply keeps your regulator on the air* round the clock or powers your 100w HF station 60 hrs a month. Circuit circuit speeds charge, protects gel cells & sealed batteries. Fully assembled, QRV, portable. Easily expanded.

Add \$10 S&H Info \$1 **Antennas West**
 (801)373-8425 Box 50062 Provo UT 84605

CIRCLE 236 ON READER SERVICE CARD



HamCall / CD-ROM

500,000 HAMS plus
 1,000's of Public Domain
 Amateur Radio Programs and Data
 Now with International

CD-ROM Disc \$50.00
 Shipping (per order) \$5.00

SUCKMASTER Publishing
 Route 4, Box 1630 Mineral, VA 22117
 703-864-5777 • 800-282-5628

CIRCLE 56 ON READER SERVICE CARD

SURVEILLANCE

COUNTERSURVEILLANCE Electronic Devices

Miniature Transmitter Kits... \$29.95
 Voice Changers, Phone Scramblers, Vehicle Tracking, Phone Recording Systems, Bug & Phone Tap Detectors, & More!

CALL IDENTIFIER device • displays callers phone number before you answer with date & time of call... \$49.95

FOR CATALOG SEND \$5.00 TO...
EDE P.O. Box 337, Buffalo, NY 14226 (716) 691-3476

ELENCO & HITACHI PRODUCTS AT DISCOUNT PRICES

48 HOUR SHIPPING

Hitachi RSO Series

(Portable Real-time Digital Storage Oscilloscopes)
 VC-6023 - 20MHz, 20MS/s \$1,995
 VC-6024 - 50MHz, 20MS/s \$1,995
 VC-6025 - 50MHz, 20MS/s \$2,195
 VC-6045 - 100MHz, 40MS/s Call
 VC-6145 - 100MHz, 100MS/s Call

RSO's from Hitachi feature roll mode, averaging, save memory, smoothing, interpolation, pretriggering, cursor measurements. These scopes enable more accurate, simpler observation of complex waveforms. In addition to such functions as hardcopy via a plotter interface and waveform transfer via the RS-232C interface. Enjoy the comfort of analog and the power to digital.

25MHz Elenco Oscilloscope

\$349

S-1325

• Dual Trace

• 1mV Sensitivity

• 6" CRT

• X-Y Operation

• TV Sync

• (2) 1x, 10x Probes included

• Includes probe, schematics, operators manual and 3 year (2 yrs for Elenco scopes) world wide warranty on parts & labor. Many accessories available for all Hitachi scopes. Call or write for complete specifications on these and many other fine oscilloscopes.

1x, 10x Scope Probes: P-1 65MHz \$17.95, P-2 100MHz \$21.95

SPECIAL BUY

V-212 - 20MHz Scope **\$409**

Hitachi Portable Scopes

DC to 50MHz, 2-Channel, DC offset function, Alternate magnifier function

V-525 - CRT Readout, Cursor Meas. \$995

V-523 - Delayed Sweep \$975

V-522 - Basic Model \$875

V-422 - 40MHz \$775

V-223 - 20MHz delayed sweep \$695

V-222 - 20MHz deluxe \$625

PRICE BREAKTHRU

20MHz Digital Storage Oscilloscope

• Analog/Digital Scope

• 2K word per channel memory

• 10MS/s sampling rate

• State-of-art technology

• Includes probes

S-1360 60MHz Delay Sweep \$775

HITACHI COMPACT SERIES SCOPES

This series provides many new functions such as CRT Readout, Cursor measurements (V-1085/1085A/85A), Frequency Dr. (V-1085), Sweeptime Autoringing, Delayed sweep and Trigger Lock using a 6-inch CRT. You don't lose the compactness in terms of performance and operation.

V-660 - 60MHz, Dual Trace \$1,149

V-665A - 60MHz, DT, w/cursor \$1,345

V-1060 - 100MHz, Dual Trace \$1,395

V-1065A - 100MHz, DT, w/cursor \$1,649

V-1085 - 100MHz, QT, w/cursor \$1,995

V-1100A - 100MHz, Quad Trace \$2,195

V-1150 - 150MHz, Quad Trace \$2,695

Elenco 40MHz Dual Trace

\$495

Good to 50MHz

• High luminance FT CRT

• 1mV Sensitivity

• 10KV Acceleration factor

• 9ns Rise Time

• X-Y Operation

• Includes (2) 1x, 10x Probes

B + K

TEST EQUIPMENT

All Models Available

Call for special price

Soldering Station

Temperature Controlled

SL-30 \$99

Digital Display

Temp Range:

300F-500F

Grounded Tip

Overheat Protect

Video Head Tester

HT-200

\$44.95

Tells you if

VHS head

is defective

or worn.

A must for

VCR work

COMPUTER INTERFACE

TRAINER

XK-400

\$139.95

Convert your IBM PC/XT or compatible

computer into a

trainer

Color Convergence Generator

CG-250

\$89.95

Fixes in the industry

10 rock steady patterns

RF & Video output

Digital Capacitance Meter

CM-1500B

\$58.95

9 Ranges

1pF to 2000pF

5% basic accuracy

Zero control w/Case

Big 1" Display

Digital LCR Meter

LC-1801

\$125

Measures:

Coils 1uH-200K

Cap: 1pF-200uF

Res: 0.1-20M

Big 1" Display

Multimeter with Capacitance & Transistor Tester

\$55 CM-1500B

Reads Volts, Ohms

Current, Capacitors

Transistors and

Dodes w/ case

FLUKE MULTIMETERS

Scopemeters (All Models Available Call)

Model 93 \$1,095.00

Model 95 \$1,395.00

Model 97 \$1,695.00

Model 10 \$62.95

Model 12 \$79.95

70 Series

Model 701 \$65.00

Model 711 \$145.00

Model 791 \$169.00

80 Series

Model 87 \$299.00

True RMS 4 1/2 Digit Multimeter

M-700T

\$135

0.5% DC Accuracy

1% Resistance

with Freq. Counter

Data Hold

Quad Power Supply

XP-580

\$69.95

2-20V @ 2A

12V @ 1A

5V @ 3A

5V @ 5A

Fully regulated and short circuit protected

Triple Power Supply

XP-620

Assembled \$75

Kit \$50

2 to 15V @ 1A

2 to 15V @ 1A

(or 4 to 30V @ 1A)

and 5V @ 3A

All the desired features for doing experiments

Features short circuit protection, all supplies

GF-8016 Function Generator

with Freq. Counter

\$249

Sine, Square, Triangle

Pulse, Ramp, 2 to 2MHz

Freq Counter: 1 - 10MHz

Int/Ext operation

GF-8015 without Freq. Meter \$179

Function Generator

Box

\$9600

\$28.95

Provides sine, triangle, square

wave from 1Hz to 1MHz

AM or FM capability

Learn to Build and Program

Computers with this Kit

Includes: All Parts, Assembly and Lesson Manual

Model

MM-8000

\$129.00

Wide Band Signal

Generators

SG-9000 \$129

RF Freq 100K-450MHz AM Modulation

of 10KHz Variable RF output

SG-9500 w/ Digital Display \$189

150 MHz built-in Counter \$249

Specifications LK-1:

Input voltage

12VDC @ 1.25 amp

Output voltage

2-3KV @ 3.4 S.M.A.

Trigger voltage

6-8KV

Laser power

1 milliwatt

Laser tube type

helium - neon

Laser tube size

1.125" dia x 5.75" long

Mirror & Motor Kit

This unique kit allows you to project laser patterns on the ceiling or walls. You change the patterns by varying the speed of the motors. The kit comes complete with 2 motors, 2 front stage mirrors, 2 motor brackets and 1 power rheostat control to vary speed of the motor

Model LM-1 \$19.95

15 DAY MONEY BACK GUARANTEE

2 YEAR WARRANTY

WRITE FOR FREE CATALOG

C&S SALES INC.

1235 ROSEWOOD DEERFIELD IL 60015

FAX: 708-120-0895 • 708-341-0110

WE WILL NOT BE UNDERSOLD

ABOVE & BEYOND

Number 18 on your Feedback card

VHF and Above Operation

C. L. Houghton WB6IGP
San Diego Microwave Group
6345 Badger Lake
San Diego CA 92119

PMTs and Lasers

Now that you have PUFF well under your belt from the previous columns, I hope you have as much fun with it as I have had. Writing explanations helped me better understand PUFF and become more familiar with its commands, and I hope that covering it in this way will remove any start-up difficulties you might encounter. PUFF is a very complex program and there are still many different applications that need to be further explored. The booklet that comes with it gives examples of those applications, and in future columns I will cover some of these other aspects. If you come up with any interesting applications please drop me a note describing them and I will be glad to share them in this column. I am sure that some questions will surface regarding PUFF operation and I will try to cover them in the column as they come up.

Laser Operation

This month I would like to describe some new developments concerning laser operation. Quite some time ago I was involved in the construction of a system using HeNe (Helium-Neon) for a laser communication system. This was primarily due to the large number of HeNe laser tubes becoming available on the surplus market at low prices. In addition to the HeNe laser, I acquired quite a few different types of detectors for evaluation in our system receiver. I tried some very expensive solid-state pin photodetectors and the good old surplus photomultiplier tubes. Not being optics-savvy at first, I was surprised that the photomultipliers showed the highest system gains. Being an amateur, I first naturally selected the (PMT) photomultiplier for use in our top-end receiver. Its surplus cost was low.

Several amateurs helped me obtain different PMTs for test evaluation. There were various types, with all different sensimetric sensitivities. Specific PMTs are sensitive to different frequencies of light. It is very difficult to get a PMT with peak sensitivity to our laser (HeNe), which peaks at 632.8 nanometers, or 6328 angstroms, the frequency of red light. Most PMTs' sensitivity to the frequency gave about 10 to 20 percent efficiency. Even at this low percentage, operation sensitivity was remarkably high.

A little perspective on laser transmitters and receivers might be in order. The detector in a laser system can be a pin diode or a (PMT) photo-

multiplier. These two types are very sensitive. A solar cell could be used, but it gives poor sensitivity in contrast to the pin diode or the PMT. This detector is used to detect the laser beam and recover the modulation that is impressed on the beam. There will be no output listening to a laser beam that is continuous (CW) mode.

The laser beam must be modulated for the detector to recover intelligence. Normally, a laser is modulated by a simple 12-volt muffin fan such as is found in many of the IBM type computer power supplies. This DC fan is mounted in such a way that the continuous beam from the laser is passed through the rotating blades of the fan. The rate with which the fan blades "chop" the laser beam is the same audio rate that is transmitted. Code is transmitted by use of a shutter or your hand forming CW code on the beam's modulated rate (three long openings of the shutter and you have sent the letter "O").

This modulation rate (1 kHz) is easily detected and amplified by low frequency audio amplifiers. The prime key to success in this amplifier is the first stage. The amplifier should have high gain and very good low frequency noise response (that's a good low noise audio transistor). Additionally, it should have some form of feedback in

the stage that maximizes gain at the audio frequency of interest. This feedback circuit prevents gain at other frequencies and accentuates the frequency of interest about 1 kHz, providing maximum gain there. See this column in the May, June and July 1991 issues of 73 Amateur Radio Today for more on the laser topics and on power supply construction in general.

Power Supply

Let's get into some application details for a proposed low current power supply driver that can power PMT's. When the circuit is fully developed I will cover final test results for evaluation.

A new power supply system might not seem very important, even for portable photomultiplier tubes. However, battery conservation is quite important when operating from field locations. We not only reduce the weight of extra batteries but most likely increase the time we can operate from our existing battery. The problem with PMT tubes is that they require a high-voltage source of 1,000 to 1,250 volts DC distributed through a voltage divider made up of resistors across the dynodes (tube elements). This voltage divider traditionally was constructed with 100k to 470k ohm resistors in a series string of 10 or more resistors (see Figure 3). The actual number of resistors used depends on the number of tube elements (dynodes) for your particular PMT.

With a high voltage supply of 1,250 volts DC this usually means a current requirement of several milliamperes (0.001 to 0.003 mA) flowing through

the network. Most of the current is used up in the resistor network as the tube current requirement is nil, or microamperes (almost nothing). Now, at first glance this doesn't seem like much but consider that 3 mA at 1,250 volts DC is almost 4 watts of power. Quite a bit, with almost 90 percent of it going to nothing more than heating the resistor string.

Enter the Cockroft Walton circuit to solve this power-hogging problem. The circuit is basically a voltage doubler that is stacked on end in an arrangement of capacitors and diodes. It has seen use in laser power supplies, multiplying its 1,500 to 2,000 volts (necessary to sustain a HeNe laser) to a starting voltage of around 10 Kv to ionize (start/ignite) a laser. See Figure 1, the laser starting circuit. This circuit can be adapted to the photomultiplier tube because the tube does not draw an appreciable amount of current from the multiplier assembly. (This multiplier arrangement cannot support much current demand from the PMT load.)

This is where the two circuits, laser and photomultiplier, differ. The laser requires a 10 kv high starting voltage to ionize the gas in the HeNe laser tube and when it ignites it draws a large amount of current: 5 to 30 mA, depending on the tube type. The starting circuit disconnects on high current at this point. It's still there but, due to the small value of the capacitors used, it cannot maintain the multiplication operation. The diodes are still in the circuit but are now just series pass elements and are, for the most part, invisible.

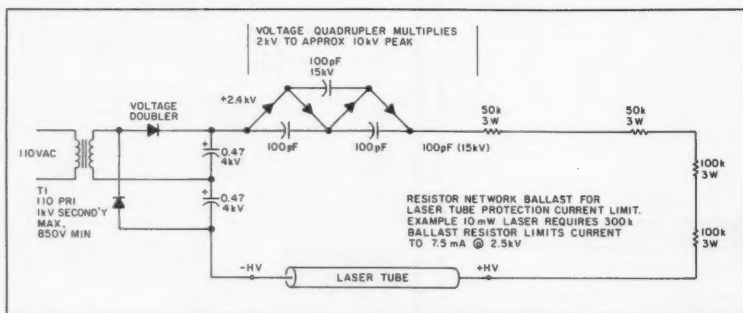


Figure 1. Laser power supply starting circuit.

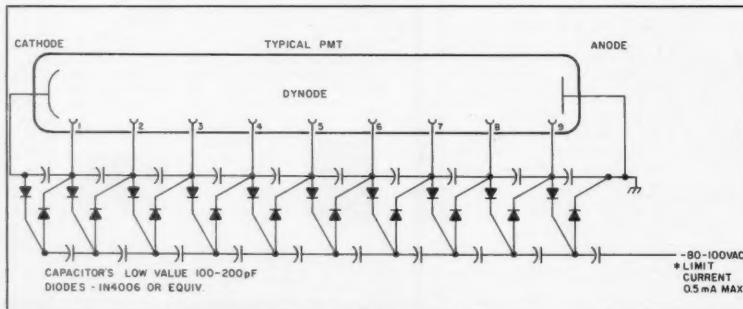


Figure 2. New PMT power supply drive circuit.

With a photomultiplier tube the current requirements are very minimal, near static values, so the multiplier approach can be tried. I haven't had time to construct a full working model of this method but I thought you might like to see what it's all about. See Figure 2 for the circuit details. Notably, the circuit is an extension of the circuit shown in Figure 1. The resistors have been eliminated and a large capacitor diode network is used in their place. The beauty of this circuit is that power dissipation is minimal and it can be constructed using low voltage components, in contrast to the high voltage components used in the laser power supply (there you must use components in the 5 to 10 kV range). In the new circuit, low voltage diodes and capacitors with low PIV voltage can be used. This makes construction right out of the junk box quite practical and inexpensive compared to a conventional high voltage power supply.

The values I would select for a first test could be 1N4006 or similar, with a 600 PIV rating (overkill on my part). The capacitors can be anything handy, from 100 to 200 pF or so. I plan to use 100 pF capacitors as I have a large quantity of disc ceramic 1 kV types on hand. Matter of fact, if you need capacitors, I will be glad to mail you a handful for postage costs, about \$2. The power supply multiplier circuit is driven from a stepped-up AC source. This is where I plan to construct a simple switching driver, possibly a 555 driving a transistor pair with a small toroid transformer stepping up voltage from 12 volts DC to about 40 to 80 volts AC to drive the multiplier. Current limiting must be used between the multiplier and power supply to prevent the tube from trying to draw abnormally high current from the diode stack, unlike the old resistor type circuit which is naturally inhibited. The total current should be kept below 1/2 mA.

As I get more time I will present the final circuit as it develops. I am very anxious to use something like this for portable PMTs. In past laser systems, the PMT power supply gobbled as much of the battery consumption as did the laser (6 watts at 12 volts = 1/2 amp battery current for the PMT). This circuit promises to decrease battery drain, making portable operation on batteries easier. I apologize for not fully developing the circuit right now—I have many other microwave operation projects in the works right now, like getting ready for Field Day and the 10 GHz ARRL contest weekends in September/August.

Column Credits

There are many different people that help with ideas and suggestions, not to mention some of them lending me their circuits to publish. I could not do this work without their help. I also have to rely on many members of the San Diego Microwave Group to furnish ideas and methods, circuits and such to present here. I could not do this column without them, or without

you for that matter. All contributions are appreciated.

Good Surplus Supplier

For your information, I discovered a good supplier of surplus material called Halted Specialties (3500 Ryder St., Santa Clara CA 95051; phone (800) 442-5833 to order). They specialize in surplus materials and are putting together a new catalog. At present they have a 2 mW HeNe laser tube for \$15, and a 24-volt input supply available to power the HeNe's for about \$40. Also available are 12-volt power supplies, but they are more expensive. I thought you might be able to find something you are looking for as materials can be hard to obtain sometimes. I just ordered some material from them and their service was very prompt—I received the material in three days via UPS.

New Projects

Let me know what you are working on and I will be glad to make it part of the column. As far as new items are concerned, I should be receiving a 5.6 GHz mixer circuit in the mail soon and I plan to construct several PC boards for development. I'll publish the artwork in this column when tests are complete on the mixer. Kerry N6IZW is working on a frequency synthesizer with a quite novel approach. It can be adapted to stabilize almost anything, even a HP-608 Hewlett Packard signal generator. The heart of the system is a microprocessor that measures the period of input signal and uses this period to stabilize the circuit. I am watching the development and it's quite an interesting circuit. Also, we built a stabilizer for the phase-locked brick type oscillators and will present that in an upcoming column.

Mail Box

Roy Wilmer K7YWF writes that he has been active since 1959, mainly on the VHF bands and that I, through this column, have got his interest up in exploring the microwave bands. He has been gathering parts and pieces. Recently Roy received a commercial wideband FM transmitter and receiver for 4.7 GHz. This equipment was all solid-state, with a Fairchild brick oscillator in the receiver. Roy is currently looking at the possibilities of making modifications to the equipment to put it on the 5.6 GHz microwave band.

In his junk box Roy also has two Ma-Com Gunnplexers™ for use in mountain-topping on 10 GHz microwave as soon as IF systems can be constructed for these units. Roy is

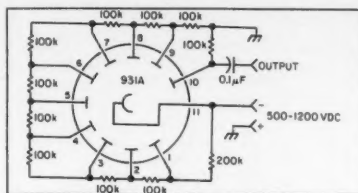


Figure 3. Typical surplus 931A PMT.

looking forward to mountain-topping in the Utah/Las Vegas area.

The IF board Roy plans to construct is based on the TDA-7000 design I presented from Signetics. However, I am having trouble getting a source of new chips as my distributor and his factory are out of stock at present. [ED Note: The TDA-7000 chip is currently available from DC Electronics, P.O. Box 3203, Scottsdale AZ 85271; (800) 423-0070 or (602) 945-7736.] If this persists I will redesign the board and use a Motorola chip that is a lot easier to obtain, the MC-3357. This chip is quite similar to the "TDA-7000" in operation but has several unique features. It is made to operate as a 10.7 MHz IF system, making a converter ahead of it necessary. By the way, many different HTs use this chip, including some of ICOM's products.

Fred Spinner KA9VAW of Terre Haute, Indiana, writes that he is much closer to graduating (in electronics). He is having quite a time experimenting with MMIC amplifiers, and states that they're great. He included some information on WEFAX picture format information for 1691 MHz. The specs are as follows: modulation FM, deviation +/- 9 kHz; ground signal level, -134 dB; video mode, APT (automatic picture transmission); video subcarrier, 2400 Hz; video modulation, AM; line rate, 4 Hz or 240 lines/minute; scan left to right, top to bottom.

Fred inquired about my WEFAX system, which is not active at present. I constructed a system using an 8-foot dish and appropriate feed, coupled to a surplus amplifier that gave about 35 dB gain and had a 2 dB noise figure. I used a friend's 137 MHz receiver for downconverting and the lash up, while not really permanent, did work. It would take additional effort to mount the dish permanently focused, but my wife objects to it so it came down after the test. Right now I am copying the WEFAX charts from a re-transmission station in the Stockton, California, area on 6.453 MHz. Signal strength is quite good and the charts are also very good quality. Once in awhile (daily) they re-transmit actual satellite pictures, and on a VGA monitor they're very good. At other times they broadcast surface analysis, sea temps, and satellite imagery. Great stuff! Besides, you don't need to have a dish in the yard. Note: A good low-noise preamp for the 1691 comes from the innards of a junked Ku band "LNB."

Glenn Baumgartner KA0ESA from Springfield, Virginia, is planning to construct a stable beacon from a Fre-

quency West brick, using it as a "set-and-forget" source for a beacon. He is planning to set it near the 10.265 MHz frequency, halfway between the standard wideband FM frequencies of 10.280 and 10.250 MHz.

Ralph Herzler WA8WBP acquired a couple of Solfan wideband FM alarm units and wants to know how to bring them down to the ham bands. Of the two units he has, one draws normal current (about 150 mA) and will set off radar detectors when activated. The other just draws current and does not appear to function, compared to the first unit. Additionally, the units have an RC network tied to the receive diode to receive wideband FM with some kind of FM strip. Should this network be removed, how is the connection made to the receiver? What diodes are suitable for receiving?

Well Ralph, let's take the questions one at a time. First frequency adjustment of the cavity. The tuning screw is lowered into the cavity about three turns to bring typical units from their normal frequency of 10.525 MHz to something near 10.250 MHz. This screw (10/32) is fixed on top of the cavity with a lock nut. Looking inside the cavity (with the unit off), its pointed screw is in the middle of the cavity. Removing the screw from the cavity increases frequency. You need a wavemeter or frequency counter to set frequency accurately.

An alternative method is to find someone who is known to be on frequency and set up a work bench test adjustment. With an IF of 30 MHz you will be either high or low by 30 MHz, but in the band and operational. Concerning the defective unit: If current is in the normal range (140 mA) for a 10 mW power device, the trouble could lie in adjustment of the iris screw (cavity opening, 4/40 screw and lock nut). Don't confuse this screw with the 4/40 screw on the horn antenna. The iris screw is the other one (not on the horn antenna).

The Solfan units came with a combination RC network on the detector diode (1N23 type), and this should be removed. Leave the RFC if it's still there as it provides a DC return for diode current. If you do not have an RFC on the diode to ground, you will suffer from poor sensitivity. Diode current is adjusted for something near 1/2 to 1 mA, as measured from diode to ground (in series with RFC). The diode (1N23) 10 GHz device is coupled out with a small value capacitor to any preamp or converter input of 0.001 µF or less. The 1N23 devices look just like 1N21 devices (same package). However, 1N21 devices are only rated for 6 GHz (6,000 MHz). I have trouble with that statement as to me it should be CYCLES, not HERTZ. It's the same trouble with the metric system, but then we all have lots of rethinking to do.

Well that's it for this month. As always I will be glad to answer questions on VHF and related subjects, for a prompt reply please enclose an SASE. 73 Chuck WB6IGP.

Indoor or Window-Mounted Dipole *Continued from page 12*

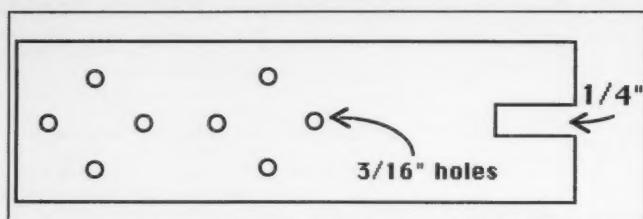


Figure 2. Approximate locations of the bracket mounting holes and the slot for the C-clamp in the mounting board.

mount. However, the type of clamp shown in the photos will rust if it is left outdoors.

The element with the center insulator, coax connector, and spring attached to it should be inserted into the bracket pointing upwards, not as shown in Photo G. The spring will fit into the bracket more securely if you open up the outer end of the bracket a bit wider so that the spring fits inside it. This can be done by flattening the side of the bracket in a vise, as shown in Figure 3.

The two mounting brackets must be connected together. Use a short wire with ring terminals that fit over the mounting bolts for the brackets.

Safety

Never operate the antenna so that anyone could come in contact with it. Shocks

and RF burns are a real possibility with an indoor antenna.

Also give attention to hazards of electromagnetic radiation from this antenna, and place it as far as possible from you, your family, and your neighbors. [Ed. Note: Use the minimum power that is necessary for communications when operating the antenna indoors.]

When considering possible outdoor locations, never place the antenna where it could possibly fall on someone. Since it is likely that you will eventually drop part of the antenna, attach a safety cord to each element before putting it out the window to mount it, and tie the other end to a heavy piece of furniture.

A patent application is pending on these coils, but amateurs are welcome to build this

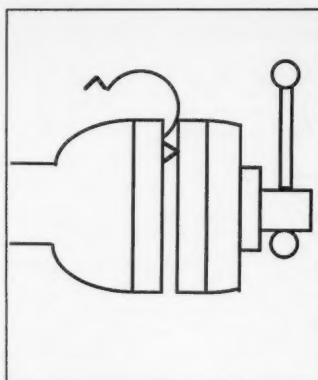


Figure 3. Using a vise to flatten the edges of a flagpole bracket to make the end half-ring a little larger so that the spring will fit in.

antenna for their own use. Coil ribs and antennas are available from Urban Antennas, Inc., P.O. Box 662, Bryn Athyn PA 19009; (215) 947-0235.

Table I
Loading Coil Dimensions

Band	Turns for 8' antenna length
12m	1.0
15m	2.0
17m	2.3
20m	4.0

The Best Shortwave You Can Buy Comes From Drake



The Drake R8 Communications Receiver...simply the best shortwave clarity and fidelity you'll find, outperforming receivers costing much, much more.

Famous Drake technology gives you wide frequency coverage of all world bands and excellent dynamic range...in an uncluttered package with an ergonomic front panel, featuring keypad entry of functions.

For the best access to world events as they happen, buy yourself a Drake R8 shortwave receiver. Ask your dealer for more information, or contact a Drake sales office today at **1-800-723-4639 (1-800-RADIO-DX)**.

DRAKE

We Bring the World Closer

R. L. Drake Company, P.O. Box 3006, Miamisburg, OH 45343, USA Tel: 513-866-2421
Drake Canada, 655 The Queensway #16, Peterborough, Ontario K9J 7M1, Canada
Tel: 705-742-3122
1-800-723-4639 (1-800-RADIO-DX)

©1991 The R.L. Drake Co.
CIRCLE 147 ON READER SERVICE CARD

NEW ONLINE CALL DIRECTORY

Our new **HAMCALL** service gives you 494,114+ Hams, via your computer. \$29.95 per year — unlimited use!

BUCKMASTER PUBLISHING
Route 4, Box 1630 Mineral, VA 23117
703: 894-5777 800: 282-5628

CIRCLE 7 ON READER SERVICE CARD

Fast & Fun G5RV QuickKits™

created by **InterHammer™** (M. Box 5060'S, Provo, UT 84606) (M)
Fast & Easy to Build
• Full-size visual instructions
• No measuring or cutting
• Everything included
• Finish antenna in minutes
• Quality Components
• Pre-soldered Silver Finings
• Kinkproof QuietFlex wire
• Fully insulated, wax sealed, air-cond. low noise design
• Tune All Bands Incl WARC
Want Plans, Patterns, Data? Order TechNote #124-D \$6.95 ppd USA
Double Size G5RV \$59.95
204 ft. 160-10 Dipole \$39.95
Full Size G5RV \$39.95
102 ft. 80-10 Dipole \$29.95
Half Size G5RV \$25.95
51 ft. 40-10 Dipole \$25.95
Quarter Size G5RV \$25.95
25 ft. 20-10 Dipole \$25.95
Ready-Made 102 ft G5RV \$50.00
Ready-Made 51 ft G5RV \$40.00
200' Dacron 250' line \$11.95
Order: Visit-Line \$22.55 ppd
1-800-926-7373

CIRCLE 298 ON READER SERVICE CARD

Speak To The World

Amateur Radio Language Guide

• Written especially for the ham radio operator
• Hundreds of phrases • Vol. 1—incl. French, Spanish, German, Japanese, Polish • Vol. 2—incl. Swedish, Italian, Portuguese, Croatian, Norwegian. Vol. 3—incl. Russian, Danish, Czech, Korean, Hawaiian. **ONLY \$10**
Send \$10 per vol. in U.S. (outside U.S. \$12.50 per vol.)

ROSE, P.O. Box 796, Mundelein, IL 60060-0796

CIRCLE 134 ON READER SERVICE CARD

X-BAND TRANSMITTER



Miniature (2 1/4 x 3 3/4 x 1") GaAs microstrip transmitter provides 10 dBm centered at 10.525 GHz. Integrated microstrip patch antenna eliminates the need for an external antenna. Advanced matching techniques secured good temperature stability with low frequency pulling. Great for long-range testing of radar detectors, calibration of radar receiving equipment, and point-to-point communication links.

Complete Assembled System \$39.00
Parts & Instruction Kit \$29.00
Plus \$2.00 Shipping and Handling

INNOTEK Inc.

P.O. Box 80096, Fort Wayne, IN 46898
(219) 489-1711

Visa • MasterCard • Check • Money Order • COD
Money-Back Guarantee

CIRCLE 293 ON READER SERVICE CARD



GOLD QST

AEA and Kantronics Owners: You need the advanced features in PKGOLD for AEA and KaGOLD for Kantronics. Put away Pakratt, Hostmaster, Lan-Link Acuterm, even TCP/IP. Superior features & performance in all modes.

You Compare: File transfers, conferences, Multi-Session power, Cut and Paste buffer, Scroll Back buffers, Robot CQ mode in all non-Packet modes, Logging, Packet and ARQ Quick Connects, Screen blanker, DOS shell, and much more. Requires 8088 to 80486 DOS systems, desk or laptop, 25/43/50 line mode. User selected colors, any serial port, runs in Windows & Desqview. KaGOLD requires ver 5.0 ROM. PKGOLD runs on any AEA TNC. Easy install, easy to run, powerful features. The choice of demanding users worldwide.

How to Order: KaGOLD or PKGOLD with Manual, Online Help, Sound Tutor disk, Technical Support, Landline BBS access is only \$79.95, plus \$5 for S&H. CA res add 7.75% sales tax. InterFlex Systems, PO Box 6418, Laguna Niguel, CA 92607-6418. (714) 496-6639. Include your call sign. VISA/MC

CIRCLE 77 ON READER SERVICE CARD

GIVE YOUR HR-2510 HR-2600 the same features as the "BIG RIGS"

- 30 Memory Channels
- Automatic Repeater Offset
- Programmable Transmit Timeout
- Programmable Seek/Scan (5 KHz, etc)
- Programmable Mike/Channel Buttons
- Programmable Transmit Freq. Limits
- Extended Frequency Range (10 to 12 meters)
- Priority Channel
- Split Frequency
- Many More Features

All these features by replacing your radio's existing "CPU" chip!
(Priority Channel requires optional hardware)

\$59.95 (Optional Chip Socket \$7.50)
Includes Operator's and Installation Manuals

CHIPSWITCH®

4773 Sonoma Hwy. Suite 132
Santa Rosa, CA 95409-4269

Write or call (707) 539-0512 for free information
Quantity prices available, Dealer inquires welcome

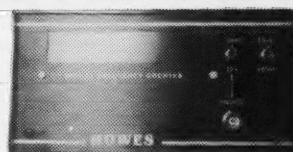
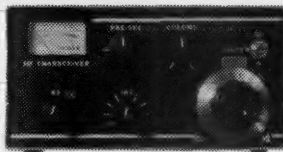
CIRCLE 265 ON READER SERVICE CARD

C.M. HOWES COMMUNICATIONS

Kits from

Townsend Electronics, Inc.
P.O. Box 415
Piercetown, IN 46562
219-839-5203 FAX 219-594-5580

NEW!



SMARTER THAN THE AVERAGE KIT!

Digital Display-Active Antennas-Receivers-Transmitters-SWR Bridge-Antenna Tuner-S Meters-SSB Transmitters-VFO's

Build your complete station one piece at a time or add units to your own station as your budget allows and discover what being a real Ham is all about, building your own!

ORDERS
1-800-944-3661

These kits feature pre-punched, finished aluminum cases for a first class appearance to reflect the first class quality of these English made units that will speak well of your craftsmanship.

Send for our NEW catalog to learn about these exciting kits and learn what being a Ham is all about!

ORDERS
1-800-944-3661

ORDER FROM:
Townsend Electronics, Inc.
P.O. Box 415
Piercetown, IN 46562
219-594-3661
FAX 219-594-5580

CIRCLE 299 ON READER SERVICE CARD

SPECIAL EVENTS

Number 19 on your Feedback card

Ham Doings Around the World

JUL 10-11

MAPLEWOOD, MN *Amateur Fair '92* will be held at the Aldrich Arena, 1850 White Bear Ave. Fri. schedule: Outside Flea Market from 6PM-9:30 PM; Commercial Exhibits from 6 PM-10 PM. Sat. schedule: Outside Flea Market 6 AM-3 PM; Commercial Exhibits 8 AM-3 PM; Grand Prize drawing 2:30 PM. The event is hobby oriented, catering to amateur radio operators, electronics hobbyists, and PC users. Admission is \$6. Children under 6 free when accompanied by an adult. Free parking. Ticket holders may sell from the Giant Outdoor Flea Market at no additional cost (no electricity). For info contact **Amateur Fair, PO Box 26331, St. Paul MN 55126; (612) 653-9999**. Computer users can call **HAM-LINK** at (612) 426-0000 (300-9600 baud).

JUL 10-12

U.S.A./CANADIAN BORDER North Dakota and Manitoba's International Ham Fest will be held at the Peace Garden. Registration will begin on the afternoon of the 10th. The Fest will end at noon on the 12th. Flea Market. Transmitter Hunts. Sunday morning Breakfast for all. The Peace Garden is located just a few miles north of Dunsmuir ND, or a few miles south of Boissevain, Manitoba. Contact **Dave Snyder, 25 Queens Crescent, Brandon, Manitoba, Canada R7B-1G1**.

JUL 11

NORTH CHARLESTON, SC The Charleston II Summer Hamfest/Computer Expo will be held from 8 AM-3 PM at the Chas. Southern Univ. Field House, North Charleston SC. Exit-205 I-26, US-78 East. Free parking. Advance tickets: \$6 family admission (2+), plus 5 prize tickets. At-the-gate tickets: \$5 single admission plus 1 prize ticket. Additional prize tickets: \$1/ea.; 6/\$5. Auction after 2 PM. Inside Flea Market Tables 1/\$10, Add'l/\$7.50 ea.; Dealer Tables (wall space and elec.) 3/\$39, 5/\$55, add'l tables \$8/ea. Outside vendor space and tailgaters: 1st 8' space \$3; 8' each add'l space. Dealer and Flea Market contact: **Roy Morrow NAARA, (803) 871-5914 (H); (803) 851-0600 (W)**. Tailgate/Outside Vendor, tour and reservation help, contact: **John Simons KCAUCP, (803) 875-3135(H)**. Talk-in on 147.27+224.64/443.80+.

PETOSKEY, MI The Straits Area ARC will sponsor a hamfest from 8 AM-1 PM at the 4-H Bldg., Emmet County Fairgrounds, 2 blocks W of US 31/131 intersection. VE Exams, Flea Market. Admission \$3. 8' tables \$3. Talk-in on 146.08/68 and 146.52. Contact **Tom Romanski N8KHE, (616) 436-5033**.

SUMMERVILLE (CHARLESTON), SC The Trident ARC will sponsor Charleston

II—Summer Hamfest & Computer Expo at the Charleston Southern U. Fieldhouse, I-26 (Exit 205) and US-78 East, from 0800Z-1500Z. Radio, Computer and Software dealers. Set-up at 0600. Wheelchair access. Free parking. Campground and motels nearby. Advance tickets \$6 per family; \$5 each at the gate. Tailgate \$3. Tables \$10. Dealers (call). True-Auction at 1400 hrs. Talk-in on 147.27+, 224.64, 443.80+. Mini-vacation planning assistance. Atlantic Ocean beaches 25 miles. Contact **Chairman: Bubba Johnson N4CH, 5 Shoo Fly Cir., Givhans SC 29472; (803) 821-8100 (recorder), or (803) 871-7741**.

JUL 11-12

BILLINGS, MT The Yellowstone RC, Inc., will hold a Hamfair at the Yellowstone County Fair Grounds, Metra Park Turf Club. Shuttle service from Billings Logan Internat'l Airport. Set-up will be all day Fri., Jul 10th. RV parking \$9.50 per day, or \$22.50 for 3 days, w/electrical hookups. Hotel room discounts are available at the Airport Metra Inn (only \$28 per night). Registration fee is \$35. Advance tickets \$5, \$6 at the door (deadline June 30th). Swap Tables: Admission plus \$10 each; \$5 for half table. Talk-in on 147.200+ MHz, 147.360+ MHz, 3900 kHz. Send check or money order for advance package to **Yellowstone Radio Club K7EFA, Eileen C.**

Jones K7BFJ, Club Sec., 1544 Foothill Dr., Billings MT 59105. Please SASE. Get more info from **Vince KB7ADL, (406) 252-8029, evs.; Eileen K7BFJ, (406) 252-2045, evs.; or Verlon K7AEZ, (406) 245-3930, days**.

JUL 12

OLD WESTBURY, NY The Long Island Mobile ARC will sponsor a Hamfest at the New York Institute of Technology, Route 25A, Old Westbury NY, from 9 AM-4 PM. VHF tune-up clinic. No advance, \$5 at the gate. Exhibitors \$10. Talk-in on 146.25/85. Contact **Neil Hartman WE2V, (516) 462-5549, or Mark Nadel NK2T, (516) 796-2366**.

AUGUSTA, NJ The Sussex County ARC will hold a Hamfest at the Sussex County Fairgrounds, Plains Rd., off Route 206, starting at 8 AM. Free parking. Admission \$4 (XYLs and harmonics free). Tailgate \$6. Indoor Flea Market \$8 per space (limited supply of tables). Talk-in on 147.90/30, 222.90/224.50, 146.52. Contact **Don Stickle K2OX, 185 Weldon Rd., Lake Hopatcong NJ 07849; (201) 663-0677**.

BOWLING GREEN, OH The Wood County ARC will sponsor its 1992 Ham A-Rama at the Wood County Fairgrounds on Poe Rd., in northwest Bowling Green,

1691 MHz Weather Satellite System

1691 MHz Hemt Pre-amp. model TS-1691-P.Amp	\$299
1691 MHz Receiver model TS-1691-Recvr	\$450
Decoder Board & Software model TS-VGA-SAT3	\$300
Decoder Board & Software model TS-VGA-SAT4	\$399
Low Loss (microwave) Coaxial Cable (65 ft) with connectors. model 1691-coax ass'y	\$55
1691 MHz Loop-Yagi Antenna model 1691-LY(N)	\$99
1691 MHz Loop-Yagi Extension model 1691-LY-XTN	\$85
Demonstration Disc (IBM-PC VGA compatible) of signals recorded from WX-SAT system.	\$5

Shipping: FOB Concord, Mass.
Prices subject to change without notice.



si

SPECTRUM INTERNATIONAL, INC.
Post Office Box 1084, Dept. S
Concord, Mass. 01742, U.S.A.
Phone: (508) 263-2145
Fax: (508) 263-7008

CIRCLE 183 ON READER SERVICE CARD

ICOM BATTERY INSERTS

BP-3	8.4v	270mah	\$15.00
BP-5	10.8v	500mah	\$21.00
BP-7	13.2v	500mah	\$23.00
BP-8	8.4v	800mah	\$21.00

KENWOOD BATTERY INSERTS

PB-21	7.2v	200mah	\$12.00
PB-21H	7.2v	600mah	\$15.00
PB24 Tabs	9.6v	600mah	\$15.00
PB-25/26	8.4v	500mah	\$18.00

YAESU BATTERY INSERTS

FNB-4/4A	12v	500mah	\$27.50
FNB-10	7.2v	600mah	\$15.00
FNB-17	7.2v	600mah	\$18.00

MORE BATTERY INSERTS

Tempo S2/4/5 Late	500mah	\$21.00
San-Tec #142#144 Tabs	600mah	\$22.00
Azden 300 Tabs	600mah	\$15.00
Bearcat	600mah	\$20.00
Regency MT1000 Tabs	600mah	\$15.00

YAESU COMPLETE PACKS

FNB-2	10.8v	500mah	\$19.00
FNB-10	7.2v	600mah	\$34.00
FNB-11	12.0v	600mah	\$52.00
FNB-12	12.0v	500mah	\$45.00
FNB-12S	12.0v	600mah	\$48.00
FNB-14	7.2v	1000mah	\$48.00
FNB-14S	7.2v	1400mah	\$59.00
FNB-17	7.2v	600mah	\$35.00

ICOM PACKS 2/4 SAT + 24AT

BP-83S	7.2v	750mah	\$38.00
BP-84	7.2v	1000mah	\$50.00
BP-85S	12v	800mah	\$60.00

*Add \$3.00 Shipping FREE Catalogue

VISA MasterCard

TNR The Battery Store
279 Douglas Ave., Suite 1112
Altamonte Springs, FL 32714
1-800-346-0601

CIRCLE 62 ON READER SERVICE CARD

Say you saw it in 73!

Why buy a TNC?
PC HF FAX + PC SWL \$179.00

SPECIAL COMBINATION OFFER

For a limited time, if you order PC HF FAX \$99 (see our other ad in this issue), you can add our new and improved PC SWL 3.0 for \$80.00 instead of our regular low price of \$99.00.

PC SWL contains the hardware, software, instructions and frequency lists needed to allow you to receive a vast variety of digital broadcasts transmitted over shortwave radio. All you need is any IBM PC or compatible computer and an SSB shortwave receiver. The product consists of:

Demodulator
Digital Signal Processing Software
200 Page Tutorial Reference Manual
World wide Utility Frequency List
Tutorial Audio Cassette with Samples
PC SWL automatically decodes Morse code, RTTY, AMTOR, SITOR, NAVTEX and ASCII.
PC SWL lets you tune in on world press services, meteorological broadcasts, ham radio operators, coastal shore stations, aviation telex and much more digital action on the shortwave bands. Why pay for another expensive box when a simple interface and your PC can do the job?

ADVANCED FEATURES:
Tuning Oscilloscope
Digital Waveform Presentations
Auto Calibration and Code Recognition
Continuously Tunable Filter Frequencies
Variable Shift
Adjustable CW Filter Sensitivity
Unattended Capture and Printing
Integrated Text Editor
Integrated Log and Database
Shell to DOS applications
Seamless Integration with PC HF Facsimile
Call or write for our complete catalog of products.
VISA & MasterCard welcome.

Software Systems Consulting
615 S. El Camino Real, San Clemente, CA 92672
Tel: (714) 498-5784 Fax: (714) 498-0568

CIRCLE 244 ON READER SERVICE CARD

starting at 8 AM. Free admission and parking. VE Exams. Trunk sales \$5. Inside tables \$10. Talk-in on 147.78/18. Contact **Wood County ARC, PO Box 534, Bowling Green OH 43402; (419) 352-3260.**

PITTSBURGH, PA The North Hills ARC will hold its 7th annual Hamfest from 8 AM-3 PM at the Northland Public Library, 300 Cumberland Rd. (10 miles north of Pittsburgh on Rt. 19N or McKnight Rd. From I-79 or the Pennsylvania Turnpike, take Rt. 19S through Wexford, turn left on to Cumberland Rd. at the second traffic light after Chunky Cheese. Talk-in will be on 147.09 (the W3BIS Allegheny County Public Service rpt). Limited indoor tables \$10 each. Free admission and parking. One free automobile-sized space per tail-gater; each additional space \$5. Wheelchair accessible. Contact **Don Jackson N3LAZ, 8 Dale Ave., Bradford Woods PA 15015; (412) 935-3343.**

DOWNERS GROVE, IL The DuPage ARC will sponsor their 10th annual Hamfest/Computer Mart, beginning at 8 AM at the American Legion Post 80, 4000 Saratoga Ave., Downers Grove IL. Post 80 is located about 20 miles west of Chicago, one block north of Ogden Ave. (Rte 34), and one block west of Main St. From I-88 exit at Highland Ave. south to Ogden, west on Ogden one block to Saratoga, one block north on Saratoga to the American Legion Post 80. Flea Market. Tailgating. Free Parking. VE Exams for all classes; please bring your license, copy of license, photo ID and certificate of successful completion, if appropriate. Tickets \$3 in advance, \$4 at the gate. Talk-in on 146.52 MHz simplex and 145.25 MHz -600, (CTCSS 107.2 Hz). For

tickets, tables or info, SASE, or call **Edwin Weinstein WD9AYR, DARC Hamfest Chairman, 7511 Walnut Ave., Woodridge IL 60517. Ham line (708) 985-9256.**

JUL 17-19

ESSEX, MT The 58th Annual Glacier-Waterton Internat'l Peacepark Hamfest will be held at the Three Forks Campground, Essex MT. Advance tickets (before July 3) are \$8.50; \$20.50 after July 3. VE Exams. For registration write to **Ethel Ferree KATHEX, Box 75, Wolf Creek MT 59648**, or call **Pete KF7R, (406) 222-2601**. All are welcome. Talk-in on 146.52. For info contact **Sheila Devitte VE6NOW, (403) 282-2171.**

JUL 18

SALISBURY, NC The North Carolina Chapter of the Triple States RAC, will sponsor a "Firecracker Hamfest" at the Salisbury Civic Center from 9 AM-5 PM. Admission, \$3 in advance (with SASE), \$4 at the door. No additional charge for Flea Market. Tables in air conditioned area, \$5. Set-up at 3 PM-9 PM Fri., 7 AM Sat. FCC Exams by W5YI. ARRL Forum at 10 AM. VEC Exams at 1:30 PM. Pre-registration required with form 610, copy of license, and \$5.25 fee. Send to **Isabell Ledford, PO Box 826, Coolemees NC 27014**. Talk-in on 146.73 or 146.655. Directions: From Interstate #85, take Hwy. #52 west/East Innes St. Turn left on South Boundary St., the Fest is on the left. For info and pre-registration contact **Walter Bastow N4KVF, 3045 High Rock Rd., Gold Hill NC 28071.**

ABILENE, KS The Smoky Valley RC will sponsor a Hamfest from 9 AM-4 PM at

Eisenhower Park. VE Exams. Talk-in on 146.88 or 145.33. Contact **Bill Fenton W00IN, 315 S. Washington, Junction City KS 66441; (913) 238-7817.**

JUL 19

CAMBRIDGE, MA The MIT Electronics Research Soc., the MIT Radio Soc., and the Harvard Wireless Club, will co-sponsor a TAILGATE Electronics/Computer/Amateur Radio Flea Market from 9 AM-2 PM at Albany and Main Streets. Admission \$2. Free off-street parking. Sellers \$8 per space at the gate, \$5 in advance (includes 1 admission). Set-up at 7 AM. Call (617) 253-3776 for reservations and info. Mail checks before the 5th to **WIGSL, PO Box 82 MIT BR., Cambridge MA 02139**. Talk-in on 146.52 and 449.725/444.725 - pl 2A - W1XMR/rpt.

WASHINGTON, MO The Zero Beaters ARC will hold its 30th annual Hamfest at the Bernie H. Hilleman Park (Washington Fairgrounds), from 6 AM-3 PM. Flea Market parking \$4 a space. VE Exams (walk-ins, starting at 10 AM—bring original license and a photocopy). Free parking. Free admission. Talk-in on 147.24 and 444.90 rptrs. Contact **Craig Brune N0MFD, PO Box 24, Dutzow MO 63342; (314) 239-0060 days; (314) 281-2784 eve. and weekends.**

FLINT, MI The 4th annual Swap and Shop, sponsored by the Genesee County RC, will be held at Dom Polski Hall on North Linden Rd., 1 mile west of I-75 and 1/4 mile south of Pierson Rd., 8 AM-1:30 PM. Advance tickets \$3, \$4 at the door. Talk-in on 147.340/940, 146.52 simplex or 444.200. Send checks or inquiries along with an SASE to **Swap Committee,**

GCRC, PO Box 485, Flint MI 48501, or call **Tom N8DYN, (313) 743-3980** for more info.

JUL 25

NORTH BEND, OR The Coos County RC will host the 2nd annual Southern Oregon Coast Hamfest at the North Bend Jr. High School from 9 AM-5 PM. Free parking. Free RV parking all weekend. VE Exams. Advance tickets \$4, \$5 at the door. Tables \$15. Large shopping mall within walking distance. Contact **R. Lyon N7SBF, Coos County Radio Club, PO Box 3494, Coos Bay OR 97420. Tel. (503) 888-2317**. Talk-in on 146.017/61 K7CCH rpt.

LANCASTER, PA The Red Rose Repeater Assn. will sponsor a Computer Fest at the McCaskey High School from 9 AM-3 PM. Set-up at 7 AM. Admission \$4; children under 14 free with paying adult. Vendor contact: **Wade Mackey, 5 Sunrise Terr., Millersville PA 17551; (717) 872-5328.**

JUL 25-26

OKLAHOMA CITY, OK The 19th annual Ham Holiday and State ARRL Convention, sponsored by Central Oklahoma Radio Amateurs, Inc., will be held at the Made in Oklahoma Bldg., Oklahoma State Fair Park. Doors open at 8 AM both days. Giant Flea Market, new and used equipment, VE Exams on Sat., RF Foxhunting, packet, computer, AMSAT, etc. Dinner Sat. eve. QCWA Breakfast Sun. morning. Advance tickets \$6, \$8 at the door. Tables \$5 in advance, \$7 at the door. Talk-in on 147.03/63. Contact **Ham Holiday 1992, PO Box 95942, Oklahoma City OK 73143-5942.**

EVERY ISSUE of 73 on microfiche!

The entire run of 73 from October, 1960 through last year is available.

You can have access to the treasures of 73 without several hundred pounds of bulky back issues. Our 24x fiche have 98 pages each and will fit in a card file on your desk.

We offer a battery operated hand held viewer for \$75, and a desk model for \$220. Libraries have these readers.

The collection of over 600 microfiche, is available as an entire set, (no partial sets) for \$285 plus \$5 for shipping (USA). Annual updates available for \$10.

Your full satisfaction is guaranteed or your money back. Visa/MC accepted.

**BUCKMASTER
PUBLISHING**
"Whitehall"
Route 4, Box 1630
Mineral, VA 23117
703-894-5777
800-282-5628

CIRCLE 168 ON READER SERVICE CARD

COMMODORE/AMIGA

REPLACEMENT CHIPS, PARTS, UPGRADES	AMIGA
COMMODORE	
6502	2.95
6526A, PLA/906114, 6567 VIC, 6581 SID, 6510/8500 CPU	9.95
All 901/225-226-227-229 ROMs	9.95
C64 Keyboard (new)	19.95
Computer Saver II/C64 protection system for spikes & power supply overload	17.95
NEW C64 Repairable Power Supply! Higher amperage (1.8) runs cool (1 year warranty)	24.95
(4.3 amp version for C64 includes Commodore Diagnostician. Perfect for packet.)	37.95
AMIGA	
8520A CIA (Most problematic chip)	10.50
1.3 Kickstart ROM	24.95
2.0 ROM chip only	39.95
8372A 1 Meg Agnus, Inc. "Final Test" diagnostic diskette/Rockwell chip puller	49.95
8375 new 2 Meg Agnus	59.95
8373 Super Denise (Enhanced Chip Set)	35.95
8362 Denise/8364 Paula	23.95
5719 Gary	12.95
GVP-SIMM-4 Mb/60	219.95
GVP G Force 40 MHz Combo/4 Mb	1,079.00
1 x 4/80 SC ZIP (A3000)	19.95
A500 PC Motherboard (populated and tested) Rev. 3	99.95
A2000 PC Motherboard (new) with 8372A/1.3ROM/8373	529.95
MegaChip 2000/2Meg. Agnus/Rockwell chip puller/ "Final Test" diagnostic diskette	299.99
A500 200 watt Big Foot Universal Switching Pwr Sup./fan	83.95
A2000 Power Supply/200 watt fan	142.50
Amiga A500 keyboard (new, exact replacement)	59.95
A2000 keyboard (new, exact replacement)	89.95
Switch-It! electronic Rom selector switch	38.50
complete compatibility with all software	
McCoy PLCC Agnus chip puller sold as Burnby by CBI for \$29. Our Price	14.95

THE GRAPEVINE GROUP, INC.
3 Chestnut Street, Suffern, NY 10901
ORDER LINE 1-800-292-7445
CUSTOM SERVICE: 914-368-4242
914-357-2424 Hours: 9-6 ET M-F Fax: 914-357-6243
We Ship Worldwide 15% Restocking Prices Subject to Change

CIRCLE 192 ON READER SERVICE CARD



ALINCO ICOM YAESU

SPECIAL SPECIAL CALL

**For This Month's Special-Buy
Some Quantities Are Limited**

FREE SHIPPING UPS SURFACE
(except power supplies and antennas)

7500 Cedar Lake Ave., Suite 100
Oklahoma City, Oklahoma 73114
Local & Info (405) 478-2866
C.O.D. Fax (405) 478-4202

CALL TOLL FREE Hours of Operation
1-800-70K-HAMS M-F 10-6
1-800-765-4267 Sat 10-3
Showroom closed Mondays

TALK WITH THE KNOWLEDGEABLE PEOPLE AT

QUEMENT ELECTRONICS

FEATURING AN EXTENSIVE LINE OF YAESU PRODUCTS



ALL MODE HF
BASE STATION

\$3699⁰⁰

#FT1000D

YAESU U.S.A.

- | | | |
|-------------|----------------------|----------|
| • FT33R/TPP | 220MHZ HT | \$328.00 |
| • FT411E | 2M HT | \$299.00 |
| • FT811 | 440 MHZ HT | \$339.00 |
| • FT470 | 2M/440 HT | \$404.00 |
| • FT911 | 122 MHZ HT | \$429.00 |
| • FT5200 | 2M/44 MOBILE | \$629.00 |
| • FT757GXII | ALL MODE HF PORTABLE | \$929.00 |

IF YOU'RE IN THE BAY AREA, STOP BY!



1000 S. BASCOM AVENUE
SAN JOSE, CA 95128
Call us at (408) 998-5900

Since 1933

CIRCLE 132 ON READER SERVICE CARD

NOW YOU CAN AFFORD THE BEST!

Engineered for the Ham, the finest in Crank-Up, Free-Standing or Guyed Towers is from Tri-Ex. For over 30 years, the INDUSTRY standard-backed with Defense and Aerospace technology.

MW SERIES

Self-supporting when attached at first section - will hold normal Tri-Band beam; 25', 33', 50', and 65' heights.

W SERIES

Aerodynamic tower designed to hold 9 sq. ft. in a 50 MPH wind at 36' and 51' heights. 67' tower rated for 6 sq. ft.

LM SERIES

"W" brace motorized tower. Holds large antenna loads. Models at 37', 54', and 70' heights.

TM SERIES

Tubular construction for larger antenna loads at 70', 90' and 100' heights. Free standing, with motorized operation.



TO ORDER CALL
800-328-2393

TECH SUPPORT
209-651-7859

FAX - 209-651-5157



Quality Structures since 1954



7182 Rasmussen Ave.
Visalia, CA 93291

CIRCLE 22 ON READER SERVICE CARD

JUL 26

MILFORD, CT The Coastline Amateur ARA will hold VE Exams for all classes at the Fowler Bldg., 145 Bridgeport Ave., at 12 noon. Walk-ins. Contact **Gary NB1M, (203) 933-5125**, or **Dick WA1YQE, (203) 874-1014**.

TIMONIUM, MD The BRATS Maryland Hamfest/Computer Fest will be held at the Maryland State (Timonium) Fairgrounds on York Rd., off I-83 and I-695, from 6 AM-3 PM. Admission \$5 per adult; children under 12 free. 8' tables in the Main Exhibit Hall are \$50 each (includes AC power and one admission ticket). 8' tables in the Home Arts Bldg. are \$25 each, no AC power; admission is additional. Set-up at 2 PM Sat. Tailgate area set-up 2 PM Sat., \$5 per vehicle space. Buyers, please note: This is not a 2-day hamfest. Sat. PM access is for dealer and tailgating set-up only. VE Exams Sun. at 10 AM in Administration Bldg.; mail your completed Form 610 to **John Creel WB3GXW, 3208 Kilkenny St., Silver Spring MD 20904**. For tables, info, write to **BRATS Hamfest, PO Box 5915, Baltimore MD 21208** or call Table Chairman **Franz Niedermeyer N3HFS, (410) 563-9147** anytime.

AUG 1

COLUMBUS, OH The Voice of Aladdin ARC will host a Hamfest from 8 AM-5 PM at Aladdin Shrine Temple, Morse Rd. and I-270 Junction on the east side of Columbus. Advance tickets \$3, \$4 at the door. Flea Market/Trunk sales \$2 per vehicle. Tables \$5 in advance, \$6 at the door. Advance registration preferred. Make checks payable to **Voice of Aladdin ARC** and mail with requests and SASE to **James C. Caines KB8KME, 1056 Erickson Ave., Columbus OH 43227-1241**. Walk-in VE Exams.

AUG 8

HUNTINGTON, WV The Tri-State ARA will sponsor Hamfest '92 & Computer Show starting at 8 AM at the Huntington Civic Center. Set-up at 6 AM. Walk-in W5YI testing for all license classes. Wheelchair accessible. YL and XYL activities. Close to all accommodations and restaurants. Donation, adults \$5, children 12 and under, free. For more info, call **Bill KF8OK, (304) 522-1933**, or **Alan N8LNS, (304) 736-9303**, anytime.

AUG 14-16

PARK CITY, UT WIMU '92 and the ARRL Rocky Mountain Div. Convention will be at the Olympia Hotel. Phone **1-800-234-9003** for reservations; mention WIMU '92 for special rates. VE Exams Fri. at 6 PM; call **NV7V, (801) 465-3983** to register. UARC is sponsoring a Steak Fry Sat. at 6 PM; \$12 per person. Swap meet starts Sat. at 8 AM, no charge for tables. Sun. at 8 AM, an All-You-Can-Eat Buffet, \$6.95 per person. Pre-register before Aug. 1, \$10; after Aug 1 and at the door, \$15. Children under 12 may register at any time for \$4. Send registration requests and checks to **WIMU '92, PO Box 67, Bountiful UT 84011-0067**. You must be registered to attend these events.

SPECIAL EVENT STATIONS

JUN 28-AUG 13

SEQUOIA NATIONAL FOREST, CA Radio Station N6PZA will be operating portable from Boy Scout Camp Whitsett, on a when-time-permits basis. Camp Whitsett is located in the southern portion of the Sierra-Nevada Mountain Range, 32 mi. north of Kernville CA. Operation will be in the 40 and 17M bands Mon.-Fri. during 2100-2400 UTC; and 17 and 20m Mon.-Thurs., 0100-0400 UTC, with occasional operation on 10m. Send inquiries to **Chuck**

Smith N6PZA, PO Box 1867, Lake Isabella CA 93240-1867. We would like to establish a possible Scout/Summer Camp Net with all Boy or Girl Scouts, Scout leaders, or Ham Radio licensed Camp Staff members who work at Boy or Girl Scout or other Youth Camps during the summer. Listen for Camp Whitsett on the General portions of the Ham Bands (especially 17, 20 and 40m) during the day.

JUL 2-12

CALGARY, ALTA. CANADA Station CJ6CEXS will operate from the Calgary Stampede, to celebrate the 125th anniversary of Canada. There will be a 8 x 10 full color poster award for \$5 U.S. funds. Any contact on any mode/band qualifies. Special QSL cards will be sent out. Talk-in on 146.850 -600 VE6RYC rpt. On the grounds, use 146.520 simplex. **QSL via VE6NAO.**

JUL 4

DELTAVILLE, VA The Middlesex AR Group will operate AC4OG, 1230-2030 UTC to commemorate Deltaville's 4th of July Celebration. Operation will be in the General portion of the 80, 40 and 20m bands. For certificate, send QSL and SASE to **Pat Muller AC4OG, M.A.R.G., PO Box 148, Locust Hill VA 23092**.

NEILLSVILLE, WI Station N9MCH will be operated by the Clark County ARES, from the Highground Veterans Memorial Park located 2 1/2 miles west of Neillsville, in southern Clark County, just off US Hwy. 10. The station will operate from 1700Z-0500Z (12 PM noon CDST to 12 AM midnight CDST). Frequencies: The bottom portion of the General 80m, 40m, 15m, and 10m phone subbands. For a Certificate, send your QSL and a 9 x 12 SASE to **The Highground, PO Box 457, Neillsville WI 54566**.

PISCATAWAY, NJ N2HOQ will operate the first 326 minutes (0000-0526Z) to celebrate the 326th Anniversary of the town. RTTY only on various HF bands. For certificate, send QSL and 9 x 12 SASE to **Geoff Malta, PO Box 312, Piscataway NJ 08855**.

STAUNTON, VA The Valley ARA will operate Station WB8GIF in conjunction with the Staller Bros. Happy Birthday USA. Operations will take place in the General portion of 80, 40, 20 and 15m CW and phone bands, and the Novice 10m band. For special glossy Certificate, send 9 x 12 SASE to **VARA, PO Box 666, Staunton VA 24401**.

JUL 4-5

BUFFALO, NY/FT. ERIE, ONT. CANADA The South Towns ARC will operate Station WB2ELW and Niagara South ARC will operate Station VE3NKH, to commemorate the 65th Anniversary of the opening of the Peace Bridge over the Niagara River (connecting Buffalo NY and Ft. Erie Ont.). They are also celebrating the annual Friendship Festival commemorating 180 years of friendship between the U.S. and Canada. Operation will be in the lower 25 kHz of the General phone subbands, the Novice 10m phone subband, the CW General subbands, 10m Novice CW subband, the WB2ELW rpt., 147.09 MHz (+600 kHz transmit) and the VE3NKH rpt., 147.165 (+600 kHz transmit). For certificate: US amateurs send QSL and SASE to **John Leiten WB2ELW, 8120 McKinley Pkwy., Hamburg NY 14075**. Canadian amateurs, send QSL and SASE to **John Gilmour VE3NKH, 158 High St., Fort Erie, Ont. Canada L2A 3R1**.

JUL 10-11

PEACE GARDEN, NORTH DAKOTA/MANITOBA BORDER In conjunction with their 29th North Dakota/Manitoba International Hamfest, VE4IHF/Ø will be in operation as a Special Event Station. Operation will be from 9 AM-5 PM. Frequencies: 3.937, 7.255, 14.255, 21.355 and 28.355, plus or minus.

JUL 11-12

U.S./CANADA Amateurs affiliated with the American Sunbathing Assn., The Naturalist Society, and Federation of Canadian Naturalists will sponsor operation of as many as 12 SE stations (40-2 meters; 10 AM-3 PM local time) to celebrate National Nude Weekend. For certificate, indicating all sites worked, send QSL(s) and 9 x 12 SASE to **AE3D, PO Box 5407, Laurel MD 20707-5407**.

NORWOOD, NY The St. Lawrence County 10m Assn. will operate WN2R to celebrate the annual "Norwood Regatta" at Norwood NY. Operation will be on the General portion of 40m and 20m and the Novice portion of 10m from 12 noon-7 PM, EDT. For a special QSL, send QSL and SASE to **Regatta, General Delivery, Norwood NY 13668**.

JUL 15

ATKIN, MN The Barton Amateur Radio Family will operate K0PVB from 1800Z-2400Z to commemorate their 40th annual visit to Sunset Bay on Cedar Lake. Operation will be in the 40, 20, 15 and 10m bands. For a certificate and honorary membership in B.A.R.F., send QSL and SASE to **B.A.R.F., c/o KADWOW, 1441 West 41st St., Davenport IA 52006**. SWLers encouraged to respond.

JUL 11-12

FULTON, NY The Oswego County Amateur Radio Emergency Service will operate KY2F from 1200Z-2100Z each day, from the Central New York Internat'l Air Show at the Oswego County Airport. Frequencies: The middle of the General 80, 40, 20, 15, and 10m phone bands; Novice portion of 10m, 147.75/15.15 MHz., and packet on 145.05 MHz. For certificate, send your QSL card and a large SASE to **Fred Swiatowski KY2F, PO Box 5227, Oswego NY 13126**.

JUL 11-19

WOOSTER, OH The Wayne AR Technical Soc. will operate N8CEY 1200Z for 15 hours Jul. 11-19 to celebrate the Ohio Agricultural Research and Development Center, "A Century of Science" at Wooster. CW: 3.550, 7.050, 10.125, 14.050, 21.050, 24.920, 28.150; Phone: 3.900, 7.275, 14.275, 21.350, 24.960, 28.350. For certificate, send QSL and a SASE to **OARDC, Mike Brugger N8CEY, 1680 Madison Ave., Wooster OH 44691**.

JUL 12

LA GRANGE PARK, IL The Six Meter Club of Chicago will operate K9ONA 1400Z-2359Z to commemorate the centennial of La Grange Park. Frequencies: Novice portion of 10m, and 146.37/97 K9ONA rpt. For QSL, send SASE; for certificate, send 9 x 12 SASE to **K9ONA, Karl Weisschappel, 802 Bardsdale Rd, La Grange Park IL 60525**.

JUL 18

DENVER, CO The Rocky Mountain Radio League will launch a high altitude balloon carrying a cross-band rpt. with the ID of NØFVG BALLOON REPEATER, at 1400Z. The input frequency will be 446.000, with the output of 147.555. The expected max.

altitude will be close to 100,000 feet. Stations 500 miles from Denver should be able to check in. Flight duration will be about 4 hours. There will be a conducted net on this rpt. All stations that check in will be sent a commemorative QSL card. Send your QSL card with an SASE to **Warren Gretz NØFVG, 3664 E. Lake Dr., Littleton CO 80121**.

JUL 18-19

STATEN ISLAND, NY The Staten Island ARA will operate W2CWW from Sat. at 1200Z-1500Z Sun., to celebrate their 70th Anniversary with the ARRL. Operation will be in the lower 25 kHz of the General 80, 40, 20 and 15m phone subbands, and the Novice portion of the 10m phone subband. Also 445.325 -5 156.7p1 club rpt. For a Certificate suitable for framing, send your QSL with a 9 x 12 SASE to **Staten Island ARA, PO Box 140495, Staten Island NY 10314-0018**.

TALLADEGA, AL The Talladega RAC will operate Station AA4UF from the Third Annual Induction of the International Motor Sports Hall of Fame, Jul. 18 from 1300Z-0500Z, and Jul. 19 from 1300Z-2300Z on 14.270 MHz (+/- QRM), in the 20m phone band and the middle of the 10m Novice phone band. For a Certificate, send QSL and two units of postage to **TRAC, PO Box 626, Talladega AL 35160**.

JUL 24-AUG 8

MONTREAL, QUEBEC, CANADA Station C12M will operate daily, Jul. 24-Aug. 8, from 1300-0100 UTC, to commemorate the 350th Anniversary of Montreal. Frequencies: SSB: 3.875, 7.250, 14.250, 21.350, 28.350 +/- QRM. SSTV: 14.230; Packet: 145.03; ATV: 439.25; VHF: 50.135, 147.045. A special QSL card will be available. Please QSL with SASE, or via VE2 bureau to **C12M via VE2CUA, Concordia University ARC, c/o CUSA H-637, 1455 DeMaisonneuve West, Montreal, Quebec, Canada H3G 1M8**.

JUL 27-AUG 2

CANTON, OH The Canton ARC will operate Station W8AL from 2200-0200 UTC Jul. 27-Jul. 31; and from 1700-2300 UTC Aug. 1-2, to celebrate the Pro Football Hall of Fame Greatest Weekend. Frequencies: SSB: 28.350, 21.350, 14.270, and 7.270; CW: 28.150, 21.060, 14.060, and 7.060. There will also be RTTY, Packet, Amlor, and 2m FM operation. SWLs welcome. For an unfolded Certificate, send your QSL and a 9 x 12 SASE, with two units of first class postage. For a QSL or a folded certificate, send your QSL and a #10 (business size) SASE to **Randy Phelps KD8JN, 1226 Delverne Ave. SW, Canton OH 44710-1306**.

JUL 31-AUG 2

DARMSTADT, GERMANY The Wiesbaden ARC will operate DA1WA/P from Frankenstein Castle, on all bands 80-10m, CW, SSB, Packet, and digital modes. A special QSL card has been printed especially for this event. QSL to **DJØPU**, SAE with 2 or 3 IRCs or "greensamps." For more info, contact **Rob Kipp DJØPU, Huegelstr. 25, D-W6070 Langen, Germany**.

AUG 1-16

LEWISTOWN, PA The Juniata Valley ARC will operate Station K3DNA in celebration of the 25th Anniversary of the US Canoe Assn. Nat'l Championships. Frequencies: The General portion of the SSB band as well as on CW. Most operation will be during the week of Aug 1-8. For a special Certificate, send an SASE to **K3DNA, PO Box 73, Yeagertown PA 17099**.

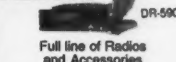
TOLL FREE 1-800-666-0908
PRICING AND ORDERS ONLY

KENWOOD

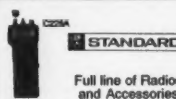


Full KENWOOD line Radios & Accessories

ALINCO

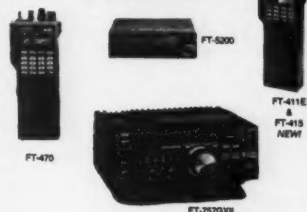


Full line of Radios and Accessories



Full line of Radios and Accessories

YAESU



Call for All YAESU Radios & Accessories

ICOM



Full ICOM line Radios & Accessories

AEA • ASTRON • COMET • CUSHCRAFT • DIAMOND • KANTRONICS • MFJ • SANGEAN • SONY SHORTWAVE • DRAKE • MANY MORE...

NEW EQUIPMENT PRICING AND ORDERS 1-800-666-0908 OUT OF STATE TECHNICAL, USED GEAR, INFO 203-666-6227 24HR FAX 203-667-3561

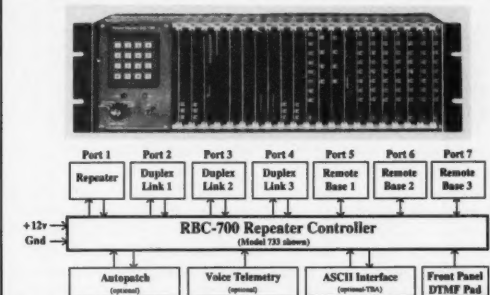
LENTINI COMMUNICATIONS INC.

21 GARFIELD STREET, NEWINGTON, CT 06111
Hours: M-F 10-6 SAT. 10-4 C.O.D.s Same Day Shipping OK

CIRCLE 234 ON READER SERVICE CARD

MULTIPLE REPEATER - LINK - REMOTE BASE CONTROLLER

Finally a controller that has solved control and audio interconnect problems between multiple radios. Your radio system can grow to multiple sites and stretch for hundreds of miles - and yet any radio can be fully controlled from any designated input.



The RBC-700 Repeater Controller is designed to support Repeater systems that require multiple radios connected together at a site. The RBC-700 utilizes a true 7 x 7 audio matrix switch which allows several conversations between ports at the same time. In the illustration above the 733 model is supporting a Repeater, 3 Duplexed Links to different sites, and 3 Remote Bases. Using simple commands, a user could tie the Repeater and a Remote Base to one Link, while the other Links are communicating through your site, holding separate conversations. Or, connect all of the ports together - like a big party line !!

Several models are available and are software configurable to support up to 3 Repeaters, 5 Duplexed Links, and 4 Remote Bases. A group or club can start with the basics and expand their controller anytime by simply adding boards and software. Free software upgrades for one year after delivery. Finally, a real controller for the Linked system operator!

Multiple Independent Repeater control
Up to 5 Duplexed Links
Up to 4 different Remotes
Recorded Natural Speech Telemetry
Programmable Macros
Connect / Disconnect multiple Ports
Internal Receiver Squelch processing

Easy servicing
Integrated Autopatch
Expand at any time
Programmable Scheduler
+10v to +14v Supply
Standard 5.25" Rack Mount
Card-Cage design

Palomar Telecom, Inc.

300 Enterprise St. Suite E • Escondido, Ca. 92025 • (619) 746-7998 • Fax (619) 746-1610

CIRCLE 284 ON READER SERVICE CARD

The Tech Answer Man

Michael J. Geier KB1UM
c/o 73 Magazine
70 Route 202-N
Peterborough NH 03458

More Digits

Last month, we were discussing digital technology. Let's continue.

Abacadabra

There are various ways to convert an analog signal to digital form and back again. The analog-to-digital converter, or ADC, has evolved over the years, with various types suited to differing tasks. One common type of ADC, the successive approximation register (SAR), works in an iterative fashion. It makes a rough guess of the correct digital value of the sample and then reconverts its guess to analog form. Then, it subtracts the reconverted voltage from the original signal in a differencing amplifier. What's left is the difference between them, which corresponds to the error in the ADC's guess. It then makes another approximation in an attempt to accurately digitize the error. With each guess, the digital representation of the signal gets closer and closer to being correct. Finally, all the error is cancelled out and the conversion is complete. This technique works remarkably well, but it takes time, due to the repetitive nature of the process. SAR converters are fine for low-frequency measurements and some audio work, but they just aren't fast enough for video or other high-frequency applications.

There's a much faster type of converter, called a flash converter, which is especially useful for video, because of its speed. This converter takes only one "pass" to completely convert its input sample. It uses a large array of voltage comparators to detect the sample's voltage. The outputs of the comparators are converted into a digital word with some logic gates. It doesn't get much simpler than that! So why not do all A/D conversion this way? Well, when you get up to more than a few bits of resolution, the number of comparators and logic gates gets to be unwieldy. Putting 65,000 comparators and thousands of gates on one chip ain't easy, especially since each comparator requires a precision, laser-trimmed resistor to provide its voltage reference. As you might imagine, flash converters are expensive.

There are other kinds of ADCs, but the objective is always the same: to sample the input waveform at discrete intervals and convert each sample into a digital number, with as little error as possible.

Hold It Right There

No matter what digitizing technique

is used, the conversion process takes time. Unfortunately, the incoming signal may change during the conversion period, introducing serious errors in the measurement. For that reason, a sample and hold circuit, which does exactly what the name implies, is used to freeze the voltage being measured until the measurement is complete. In older systems, the sample and hold circuitry was separate from the ADC, but most modern ADCs include it right on the chip, making circuit design simpler.

Give It Back!

The process of reconvertng a digital signal into its original analog form is easier than the reverse. A set of gates whose outputs are summed by a network of precision resistors makes a perfectly decent digital-to-analog converter, or DAC. Thanks to CDs, though, various new techniques for ultra-clean D/A conversion have evolved. In pursuit of ever more perfect sound, designers have developed such things as oversampling and bit interpolation, which actually synthesize data values in between the existing ones in order to make the resultant waveform smoother and easier to filter. Such things, however, are overkill for voice-grade networks; a simple resistive DAC will do fine.

We've seen how we can digitize an audio signal and the benefits and costs of doing so. Is it practical to send digitized information over the air and recover it at the receiving end? Well, maybe. The broadcast industry is experimenting right now with sending it over UHF, with the intent of providing compact-disc-quality audio directly to your home. Eventually, they plan to do away with traditional AM and FM altogether, though I expect it will be phased out over many years. So, don't go hauling your stereo gear to the hamfest just yet! Initial tests indicate that it takes far less power, compared to FM, to get the digital data across, despite the required higher bandwidth. I, for one, look forward to the time when we all aren't drenched with megawatts of RF, 24 hours a day. Of course, TV broadcasting, especially on the UHF channels, contributes most to the RF soup in which we all live. But who knows, maybe that too will be digital one day.

What About Us?

Could we hams use digital voice links? Sure, why not? For local work, digital would be excellent, perhaps providing far greater coverage from our walkies and repeaters, and perhaps making multiple-user single-channel repeaters a reality. For HF, though, it's another story. The fading, static and QRM, at least as they exist

today, would likely make data recovery very difficult. Also, high-speed, noise-tolerant modems would have to be developed at prices we could afford. If it could be done, though, we might fit far more QSOs on each band, with no audible interference from adjacent stations. It may happen, but I doubt it will be soon.

Psst... DSP

More likely, digital techniques will be showing up more and more in applications which help conventional analog systems work better than they ever have before. Already, we're seeing signal processors employing the powerful new technology of digital signal processing. Based on a high-speed, dedicated microprocessor system, DSP devices can filter audio in ways undreamed of before. For instance, you can buy a DSP notch filter which not only removes heterodynes in the conventional manner, it also finds them automatically. Even more amazing, the filter can remove several tuner-uppers at the same time! And the notch is far deeper and narrower than you can get with any analog filter; the whistles really disappear, and the desired speech signal is essentially undamaged.

Also currently available is an audio filter which can remove much of the interference caused by adjacent voice stations, along with static. This DSP filter actually analyzes the incoming waveform, looking for patterns related to normal speech. When it detects elements which don't belong there, it removes them, leaving the speech untouched. I haven't actually used such a filter, but a friend of mine has, and he says that the result is truly spectacular. Even 20m SSB can be pleasant to listen to! As the chips become more affordable, we may begin to see such filters incorporated into new radios. Even today's best rigs will sound very unsatisfying next to the DSP-equipped ones. There's a big future in DSP audio filtering technology.

Made to Order

Another area in which DSP shines is the modeling of hardware in software. In other words, a piece of hardware, such as a modem, can be emulated in the DSP chip's software. Why do it? Because you can get the same or better result with far fewer parts. Perhaps as important, you can change the circuit's characteristics simply by changing the software, with no other modifications necessary. So, as modem speeds increase through the use of more sophisticated modulation techniques, the new designs can be implemented merely by swapping a chip! Already, some multimode data controllers are using this technique, making the products nearly obsolescence-proof.

The Ultimate

If you can model an audio channel in software, thus doing away with most of the hardware, why not do the same

thing for an entire receiver or transmitter? Well, in theory, there's no reason why not! Imagine it: The antenna leads to a front end amplifier which feeds an ADC. The digital data goes into a DSP chip and out comes audio. AM, FM, SSB, you name it, the DSP can demodulate it. Tuning, of course, is handled by changing some numbers in the DSP routines. Filtering is accomplished the same way, and it can be tremendously sharper than anything we can make out of crystals or ceramics now. A rig small enough to fit into a pocket, or even be worn on your wrist, might have all the features and quality of a full-sized HF rig, and there'd be absolutely no variation from unit to unit within a given model—they'd all perform exactly the same. Wow, that's some nifty radio. No IF coils, no mixers, nothing. So why aren't we doing it?

The answer is simple: speed. It takes a DSP running at 20 MHz or more just to do audio. Imagine what it would take to process signals which are themselves in the megahertz range. Today's DSPs aren't even in the ballpark of being fast enough. But make no mistake about it, as integrated circuit manufacturing techniques advance, it will be done. To our grandchildren, and perhaps even to our children, IF coils, ceramic filters and analog receiver circuitry will seem as silly as spark transmitters do to us today. Heck, even you and I may QSO on DSP sets before our silent key notices grace the pages of history. Hey, by then we may even have settled the no-code debate! Of course, that may be asking a bit much.

Well, that about covers it in the digital domain. Now, let's look at a letter:

Dear Kaboom,

I am in need of an amplifier that will put out a couple of watts in the VHF range. Will your "Cassette Box Special" (73 Amateur Radio, April 1990) amp do it at those frequencies? What's the difference between HF and VHF amps anyway?

Signed,
Watt Pusher

Dear Pusher,

I seriously doubt the Cassette Box amp will do it for you! In basic concept, an amp is an amp, and they should all work at any frequency. But it just doesn't work out that way. RF amplifiers must deal with circuit reactance, especially component capacitances. If you try the Cassette Box amp at VHF, it probably will show loss, not gain, as it was designed to work at about 1/40 the frequency you have in mind. To get gain at VHF, you need to use the right transistor and certain low-reactance construction techniques. In particular, it is easiest to use a tuned amplifier, which permits component reactances to be used to advantage, in contrast to the wideband designs commonly used at HF.

73 and see you all next month.

TigerTail™



Range Extender for 2 meter Handhelds

- Boosts Signal from Flex & 1.4 wave Antennas
- Lowers Radiation Angle
- Improves both Receive and Transmit
- Raises Low Power Performance
- Saves your Battery Pack

Antennas West
Box 90082-B, Provo, UT 84601 1-800-926-7373

See and Hear the Difference

CIRCLE 107 ON READER SERVICE CARD

1992 CALL DIRECTORY
(On Microfiche)

Call Directory\$10
Name Index 10
Geographic Index 10

All three — \$25
Shipping per order \$3

BUCKMASTER PUBLISHING
Route 4, Box 1630 Mineral, VA 23117
703: 894-5777 800: 282-5628

CIRCLE 170 ON READER SERVICE CARD

THIS MONTH'S GOODIE FROM THE CANDY STORE

ICOM P2-AT
UNDER \$345.00

Similar Savings On Yaesu, Astron, Kenwood, Hy-Gain, Alnico, Etc. All I.T.O.

MFJ-949D \$118.50

Over 9039 Ham Items in Stock, all Prices, Cash FOB Preston. More Specials in HAM-ADS. Looking for Something not Listed?

Call Today (208) 852-0830

ROSS DISTRIBUTING COMPANY
78 S. State Street, Preston, ID 83263 • Telephone (208) 852-0830
Hours Tue.-Fri. 9-6 - 9-2 Mondays, Closed Sat. & Sun.

CIRCLE 254 ON READER SERVICE CARD

UAI-10 AND UAI-20
UNIVERSAL REPEATER/LINK
AUDIO INTERFACE



Detailed application manual
Low power operation, 19ma @ 12v
CTCSS decoder on the UAI-20 only
Assembled, tested, one year warranty
Link monitor-mix/monitor mute control
Adjustable repeater/link/DTMF audio outputs
Selectable DTMF mute on repeater and link audio
Repeater, link, auxiliary and control audio inputs

UAI-10 **\$44.00**
UAI-20 **\$89.00**

CREATIVE CONTROL PRODUCTS
3185 Bunting Avenue
Grand Junction, CO 81504
(303) 434-9405

CIRCLE 146 ON READER SERVICE CARD

QRP CW TRANSCEIVER KIT

- Available on 20M or 40M band
- Superior superhet design
- Single-signal receiver
- CW crystal ladder filter
- VFO tuning with vernier dial
- RIT w/center detent control
- Very effective AGC
- Selectable audio filter
- Sidetone oscillator
- 2-3 watts of RF output
- Semi break-in
- 12VDC operation
- Custom pre-painted, punched & silkscreened cabinet
- 100% complete kit with instructions
- Measures (HWD): 2 1/4" X 6 1/4" X 6"
- Weight: 24 oz.
- \$149.95 + \$4.50 shipping & handling. Michigan residents add 4% sales tax.

• All Coils are Pre-wound




For free catalog call or write

OAK HILLS RESEARCH
QRP HEADQUARTERS
20879 MADISON STREET
BIG RAPIDS, MI 49307
(616) 796-0920
24 HR. FAX—(616) 796-6633

CIRCLE 82 ON READER SERVICE CARD

HAMMIN' ON



it takes a WHAMMIN' and keeps on HAMMIN'

in North America contact:
OUTBACK ANTENNA SALES
330 Cedar Glen Circle
Chattanooga, TN 37412
(615) 899-3390 faxphone

Worldwide contact:
TERLIN AERIALS
unit 2, 3 Yampi Way
Willetton W.A. 6155 AUSTRALIA
tel. (011) 6194576238
fax (011) 6194577737

CIRCLE 262 ON READER SERVICE CARD



A-R-C SYSTEMS

AMATEUR RADIO COMPUTER

Full Range of Rack Mount CPU Equipment

Also Available — Stinger SCA-1 Chassis
The Ultimate in RFI Containment & Functionality

General Specifications

386, 486, ISA, EISA Motherboards
Mounts Full and Baby Boards
Up to 6 HH Drives
110CFM Cooling Fan
Optional Expansion Slot Fan
Front Switches/Locks/LEDs
300W Switching Pwr Supply
Low Noise Regulators

- Organize your station
- Utilize vertical space
- Consolidate components

- Convert current CPU to rack
- Easy access for servicing
- Configure to your needs



Crafted with pride in the USA.
©1992 Bestway Systems, Inc. All rights reserved.
U.S. patents pending.
Trademarks belong to respective owners.



1 800 477-UNIX

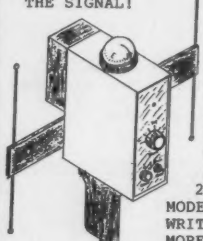


Bestway Systems, Inc.
999 Central Park Avenue
Yonkers, NY 10704
In New York State dial: 914 968-9491
Fax: 914 968-9523

CIRCLE 74 ON READER SERVICE CARD

VECTOR FINDER

ZERO-IN THE SIGNAL!



ARMED FOLD FOR STORAGE. TYPE VF-142 COVERS BOTH 2-MTRS & 220MHZ. OTHER MODELS AVAILABLE. WRITE OR CALL FOR MORE INFO.

HAND-HELD PHASE SENSE ANTENNAS FOR VHF DIRECTION FINDING. USES ANY FM XCVR. COMPASS GIVES DIRECTION. ARMS FOLD FOR STORAGE. TYPE VF-142 COVERS BOTH 2-MTRS & 220MHZ. OTHER MODELS AVAILABLE. WRITE OR CALL FOR MORE INFO.


\$3.50 SHIPPING & TYPE VF-142 CA. ADD TAX) \$129.95 619-3941 MT. BRUNDAGE AVE. SAN DIEGO, CA 92111

CIRCLE 58 ON READER SERVICE CARD

Presenting The Finest 50 MHz Yagi Available!

Model: RA4-50

Design by K3HPW



Model RA4-50

\$139.95

ELECTRICAL SPECIFICATIONS:

- Measured gain 8.20 dBS
- E-Plane beamwidth 51 deg
- H-Plane beamwidth 65 deg
- Bandwidth 1 MHz
- SWR 1.00:1 typical
- F/B ratio 30 dB
- Maximum Power 400 Watts
- Impedance 50 ohm

MECHANICAL SPECIFICATIONS:

- Length 128.4 in.
- Boom 1.25" OD 6061 T-6 Aluminum
- Elements 12' x 1/2" tubing
- Element mounts Extruded Aluminum
- Wind survival 120+ MPH
- Material up to 2" diameter
- All Stainless Steel Element Hardware
- Coax connector Waterproof N-type
- Weight 16.5 lb

ALSO AVAILABLE

RA4-50, RA7-50, RA8-50, RA12-50, RA16-50, RA20-50, RA24-50, RA28-50, RA32-50, RA36-50, RA40-50, RA44-50, RA48-50, RA52-50, RA56-50, RA60-50, RA64-50, RA68-50, RA72-50, RA76-50, RA80-50, RA84-50, RA88-50, RA92-50, RA96-50, RA100-50, RA104-50, RA108-50, RA112-50, RA116-50, RA120-50, RA124-50, RA128-50, RA132-50, RA136-50, RA140-50, RA144-50, RA148-50, RA152-50, RA156-50, RA160-50, RA164-50, RA168-50, RA172-50, RA176-50, RA180-50, RA184-50, RA188-50, RA192-50, RA196-50, RA200-50, RA204-50, RA208-50, RA212-50, RA216-50, RA220-50, RA224-50, RA228-50, RA232-50, RA236-50, RA240-50, RA244-50, RA248-50, RA252-50, RA256-50, RA260-50, RA264-50, RA268-50, RA272-50, RA276-50, RA280-50, RA284-50, RA288-50, RA292-50, RA296-50, RA300-50, RA304-50, RA308-50, RA312-50, RA316-50, RA320-50, RA324-50, RA328-50, RA332-50, RA336-50, RA340-50, RA344-50, RA348-50, RA352-50, RA356-50, RA360-50, RA364-50, RA368-50, RA372-50, RA376-50, RA380-50, RA384-50, RA388-50, RA392-50, RA396-50, RA400-50, RA404-50, RA408-50, RA412-50, RA416-50, RA420-50, RA424-50, RA428-50, RA432-50, RA436-50, RA440-50, RA444-50, RA448-50, RA452-50, RA456-50, RA460-50, RA464-50, RA468-50, RA472-50, RA476-50, RA480-50, RA484-50, RA488-50, RA492-50, RA496-50, RA500-50, RA504-50, RA508-50, RA512-50, RA516-50, RA520-50, RA524-50, RA528-50, RA532-50, RA536-50, RA540-50, RA544-50, RA548-50, RA552-50, RA556-50, RA560-50, RA564-50, RA568-50, RA572-50, RA576-50, RA580-50, RA584-50, RA588-50, RA592-50, RA596-50, RA600-50, RA604-50, RA608-50, RA612-50, RA616-50, RA620-50, RA624-50, RA628-50, RA632-50, RA636-50, RA640-50, RA644-50, RA648-50, RA652-50, RA656-50, RA660-50, RA664-50, RA668-50, RA672-50, RA676-50, RA680-50, RA684-50, RA688-50, RA692-50, RA696-50, RA700-50, RA704-50, RA708-50, RA712-50, RA716-50, RA720-50, RA724-50, RA728-50, RA732-50, RA736-50, RA740-50, RA744-50, RA748-50, RA752-50, RA756-50, RA760-50, RA764-50, RA768-50, RA772-50, RA776-50, RA780-50, RA784-50, RA788-50, RA792-50, RA796-50, RA800-50, RA804-50, RA808-50, RA812-50, RA816-50, RA820-50, RA824-50, RA828-50, RA832-50, RA836-50, RA840-50, RA844-50, RA848-50, RA852-50, RA856-50, RA860-50, RA864-50, RA868-50, RA872-50, RA876-50, RA880-50, RA884-50, RA888-50, RA892-50, RA896-50, RA900-50, RA904-50, RA908-50, RA912-50, RA916-50, RA920-50, RA924-50, RA928-50, RA932-50, RA936-50, RA940-50, RA944-50, RA948-50, RA952-50, RA956-50, RA960-50, RA964-50, RA968-50, RA972-50, RA976-50, RA980-50, RA984-50, RA988-50, RA992-50, RA996-50, RA1000-50, RA1004-50, RA1008-50, RA1012-50, RA1016-50, RA1020-50, RA1024-50, RA1028-50, RA1032-50, RA1036-50, RA1040-50, RA1044-50, RA1048-50, RA1052-50, RA1056-50, RA1060-50, RA1064-50, RA1068-50, RA1072-50, RA1076-50, RA1080-50, RA1084-50, RA1088-50, RA1092-50, RA1096-50, RA1100-50, RA1104-50, RA1108-50, RA1112-50, RA1116-50, RA1120-50, RA1124-50, RA1128-50, RA1132-50, RA1136-50, RA1140-50, RA1144-50, RA1148-50, RA1152-50, RA1156-50, RA1160-50, RA1164-50, RA1168-50, RA1172-50, RA1176-50, RA1180-50, RA1184-50, RA1188-50, RA1192-50, RA1196-50, RA1200-50, RA1204-50, RA1208-50, RA1212-50, RA1216-50, RA1220-50, RA1224-50, RA1228-50, RA1232-50, RA1236-50, RA1240-50, RA1244-50, RA1248-50, RA1252-50, RA1256-50, RA1260-50, RA1264-50, RA1268-50, RA1272-50, RA1276-50, RA1280-50, RA1284-50, RA1288-50, RA1292-50, RA1296-50, RA1300-50, RA1304-50, RA1308-50, RA1312-50, RA1316-50, RA1320-50, RA1324-50, RA1328-50, RA1332-50, RA1336-50, RA1340-50, RA1344-50, RA1348-50, RA1352-50, RA1356-50, RA1360-50, RA1364-50, RA1368-50, RA1372-50, RA1376-50, RA1380-50, RA1384-50, RA1388-50, RA1392-50, RA1396-50, RA1400-50, RA1404-50, RA1408-50, RA1412-50, RA1416-50, RA1420-50, RA1424-50, RA1428-50, RA1432-50, RA1436-50, RA1440-50, RA1444-50, RA1448-50, RA1452-50, RA1456-50, RA1460-50, RA1464-50, RA1468-50, RA1472-50, RA1476-50, RA1480-50, RA1484-50, RA1488-50, RA1492-50, RA1496-50, RA1500-50, RA1504-50, RA1508-50, RA1512-50, RA1516-50, RA1520-50, RA1524-50, RA1528-50, RA1532-50, RA1536-50, RA1540-50, RA1544-50, RA1548-50, RA1552-50, RA1556-50, RA1560-50, RA1564-50, RA1568-50, RA1572-50, RA1576-50, RA1580-50, RA1584-50, RA1588-50, RA1592-50, RA1596-50, RA1600-50, RA1604-50, RA1608-50, RA1612-50, RA1616-50, RA1620-50, RA1624-50, RA1628-50, RA1632-50, RA1636-50, RA1640-50, RA1644-50, RA1648-50, RA1652-50, RA1656-50, RA1660-50, RA1664-50, RA1668-50, RA1672-50, RA1676-50, RA1680-50, RA1684-50, RA1688-50, RA1692-50, RA1696-50, RA1700-50, RA1704-50, RA1708-50, RA1712-50, RA1716-50, RA1720-50, RA1724-50, RA1728-50, RA1732-50, RA1736-50, RA1740-50, RA1744-50, RA1748-50, RA1752-50, RA1756-50, RA1760-50, RA1764-50, RA1768-50, RA1772-50, RA1776-50, RA1780-50, RA1784-50, RA1788-50, RA1792-50, RA1796-50, RA1800-50, RA1804-50, RA1808-50, RA1812-50, RA1816-50, RA1820-50, RA1824-50, RA1828-50, RA1832-50, RA1836-50, RA1840-50, RA1844-50, RA1848-50, RA1852-50, RA1856-50, RA1860-50, RA1864-50, RA1868-50, RA1872-50, RA1876-50, RA1880-50, RA1884-50, RA1888-50, RA1892-50, RA1896-50, RA1900-50, RA1904-50, RA1908-50, RA1912-50, RA1916-50, RA1920-50, RA1924-50, RA1928-50, RA1932-50, RA1936-50, RA1940-50, RA1944-50, RA1948-50, RA1952-50, RA1956-50, RA1960-50, RA1964-50, RA1968-50, RA1972-50, RA1976-50, RA1980-50, RA1984-50, RA1988-50, RA1992-50, RA1996-50, RA2000-50, RA2004-50, RA2008-50, RA2012-50, RA2016-50, RA2020-50, RA2024-50, RA2028-50, RA2032-50, RA2036-50, RA2040-50, RA2044-50, RA2048-50, RA2052-50, RA2056-50, RA2060-50, RA2064-50, RA2068-50, RA2072-50, RA2076-50, RA2080-50, RA2084-50, RA2088-50, RA2092-50, RA2096-50, RA2100-50, RA2104-50, RA2108-50, RA2112-50, RA2116-50, RA2120-50, RA2124-50, RA2128-50, RA2132-50, RA2136-50, RA2140-50, RA2144-50, RA2148-50, RA2152-50, RA2156-50, RA2160-50, RA2164-50, RA2168-50, RA2172-50, RA2176-50, RA2180-50, RA2184-50, RA2188-50, RA2192-50, RA2196-50, RA2200-50, RA2204-50, RA2208-50, RA2212-50, RA2216-50, RA2220-50, RA2224-50, RA2228-50, RA2232-50, RA2236-50, RA2240-50, RA2244-50, RA2248-50, RA2252-50, RA2256-50, RA2260-50, RA2264-50, RA2268-50, RA2272-50, RA2276-50, RA2280-50, RA2284-50, RA2288-50, RA2292-50, RA2296-50, RA2300-50, RA2304-50, RA2308-50, RA2312-50, RA2316-50, RA2320-50, RA2324-50, RA2328-50, RA2332-50, RA2336-50, RA2340-50, RA2344-50, RA2348-50, RA2352-50, RA2356-50, RA2360-50, RA2364-50, RA2368-50, RA2372-50, RA2376-50, RA2380-50, RA2384-50, RA2388-50, RA2392-50, RA2396-50, RA2400-50, RA2404-50, RA2408-50, RA2412-50, RA2416-50, RA2420-50, RA2424-50, RA2428-50, RA2432-50, RA2436-50, RA2440-50, RA2444-50, RA2448-50, RA2452-50, RA2456-50, RA2460-50, RA2464-50, RA2468-50, RA2472-50, RA2476-50, RA2480-50, RA2484-50, RA2488-50, RA2492-50, RA2496-50, RA2500-50, RA2504-50, RA2508-50, RA2512-50, RA2516-50, RA2520-50, RA2524-50, RA2528-50, RA2532-50, RA2536-50, RA2540-50, RA2544-50, RA2548-50, RA2552-50, RA2556-50, RA2560-50, RA2564-50, RA2568-50, RA2572-50, RA2576-50, RA2580-50, RA2584-50, RA2588-50, RA2592-50, RA2596-50, RA2600-50, RA2604-50, RA2608-50, RA2612-50, RA2616-50, RA2620-50, RA2624-50, RA2628-50, RA2632-50, RA2636-50, RA2640-50, RA2644-50, RA2648-50, RA2652-50, RA2656-50, RA2660-50, RA2664-50, RA2668-50, RA2672-50, RA2676-50, RA2680-50, RA2684-50, RA2688-50, RA2692-50, RA2696-50, RA2700-50, RA2704-50, RA2708-50, RA2712-50, RA2716-50, RA2720-50, RA2724-50, RA2728-50, RA2732-50, RA2736-50, RA2740-50, RA2744-50, RA2748-50, RA2752-50, RA2756-50, RA2760-50, RA2764-50, RA2768-50, RA2772-50, RA2776-50, RA2780-50, RA2784-50, RA2788-50, RA2792-50, RA2796-50, RA2800-50, RA2804-50, RA2808-50, RA2812-50, RA2816-50, RA2820-50, RA2824-50, RA2828-50, RA2832-50, RA2836-50, RA2840-50, RA2844-50, RA2848-50, RA2852-50, RA2856-50, RA2860-50, RA2864-50, RA2868-50, RA2872-50, RA2876-50, RA2880-50, RA2884-50, RA2888-50, RA2892-50, RA2896-50, RA2900-50, RA2904-50, RA2908-50, RA2912-50, RA2916-50, RA2920-50, RA2924-50, RA2928-50, RA2932-50, RA2936-50, RA2940-50, RA2944-50, RA2948-50, RA2952-50, RA2956-50, RA2960-50, RA2964-50, RA2968-50, RA2972-50, RA2976-50, RA2980-50, RA2984-50, RA2988-50, RA2992-50, RA2996-50, RA3000-50, RA3004-50, RA3008-50, RA3012-50, RA3016-50, RA3020-50, RA3024-50, RA3028-50, RA3032-50, RA3036-50, RA3040-50, RA3044-50, RA3048-50, RA3052-50, RA3056-50, RA3060-50, RA3064-50, RA3068-50, RA3072-50, RA3076-50, RA3080-50, RA3084-50, RA3088-50, RA3092-50, RA3096-50, RA3100-50, RA3104-50, RA3108-50, RA3112-50, RA3116-50, RA3120-50, RA3124-50, RA3128-50, RA3132-50, RA3136-50, RA3140-50, RA3144-50, RA3148-50, RA3152-50, RA3156-50, RA3160-50, RA3164-50, RA3168-50, RA3172-50, RA3176-50, RA3180-50, RA3184-50, RA3188-50, RA3192-50, RA3196-50, RA3200-50, RA3204-50, RA3208-50, RA3212-50, RA3216-50, RA3220-50, RA3224-50, RA3228-50, RA3232-50, RA3236-50, RA3240-50, RA3244-50, RA3248-50, RA3252-50, RA3256-50, RA3260-50, RA3264-50, RA3268-50, RA3272-50, RA3276-50, RA3280-50, RA3284-50, RA3288-50, RA3292-50, RA3296-50, RA3300-50, RA3304-50, RA3308-50, RA3312-50, RA3316-50, RA3320-50, RA3324-50, RA3328-50, RA3332-50, RA3336-50, RA3340-50, RA3344-50, RA3348-50, RA3352-50, RA3356-50, RA3360-50, RA3364-50, RA3368-50, RA3372-50, RA3376-50, RA3380-50, RA3384-50, RA3388-50, RA3392-50, RA3396-50, RA3400-50, RA3404-50, RA3408-50, RA3412-50, RA3416-50, RA3420-50, RA3424-50, RA3428-50, RA3432-50, RA3436-50, RA3440-50, RA3444-50, RA3448-50, RA3452-50, RA3456-50, RA3460-50, RA3464-50, RA3468-50, RA3472-50, RA3476-50, RA3480-50, RA3484-50, RA3488-50, RA3492-50, RA3496-50, RA3500-50, RA3504-50, RA3508-50, RA3512-50, RA3516-50, RA3520-50, RA3524-50, RA3528-50, RA3532-50, RA3536-50, RA3540-50, RA3544-50, RA3548-50, RA3552-50, RA3556-50, RA3560-50, RA3564-50, RA3568-50, RA3572-50, RA3576-50, RA3580-50, RA3584-50, RA3588-50, RA3592-50, RA3596-50, RA3600-50, RA3604-50, RA3608-50, RA3612-50, RA3616-50, RA3620-50, RA3624-50, RA3628-50, RA3632-50, RA3636-50, RA3640-50, RA3644-50, RA3648-50, RA3652-50, RA3656-50, RA3660-50, RA3664-50, RA3668-50, RA3672-50, RA3676-50, RA3680-50, RA3684-50, RA3688-50, RA3692-50, RA3696-50, RA3700-50, RA3704-50, RA3708-50, RA3712-50, RA3716-50, RA3720-50, RA3724-50, RA3728-50, RA3732-50, RA3736-50, RA3740-50, RA3744-50, RA3748-50, RA3752-50, RA3756-50, RA3760-50, RA3764-50, RA3768-50, RA3772-50, RA3776-50, RA3780-50, RA3784-50, RA3788-50, RA3792-50, RA3796-50, RA3800-50, RA3804-50, RA3808-50, RA3812-50, RA3816-50, RA3820-50, RA3824-50, RA3828-50, RA3832-50, RA3836-50, RA3840-50, RA3844-50, RA3848-50, RA3852-50, RA3856-50, RA3860-50, RA3864-50, RA3868-50, RA3872-50, RA3876-50, RA3880-50, RA3884-50, RA3888-50, RA3892-50, RA3896-50, RA3900-50, RA3904-50, RA3908-50, RA3912-50, RA3916-50, RA3920-50, RA3924-50, RA3928-50, RA3932-50, RA3936-50, RA3940-50, RA3944-50, RA3948-50, RA3952-50, RA3956-50, RA3960-50, RA3964-50, RA3968-50, RA3972-50, RA3976-50, RA3980-50, RA3984-50, RA3988-50, RA3992-50, RA3996-50, RA4000-50, RA4004-50, RA4008-50, RA4012-50, RA4016-50, RA4020-50, RA4024-50, RA4028-50, RA4032-50, RA4036-50, RA4040-50, RA4044-50, RA4048-50, RA4052-50, RA4056-50, RA4060-50, RA4064-50, RA4068-50, RA4072-50, RA4076-50, RA4080-50, RA4084-50, RA4088-50, RA4092-50, RA4096-50, RA4100-50, RA4104-50, RA4108-50, RA4112-50, RA4116-50, RA4120-50, RA4124-50, RA4128-50, RA4132-50, RA4136-50, RA4140-50, RA4144-50, RA4148-50, RA4152-50, RA4156-50, RA4160-50, RA4164-50, RA4168-50, RA4172-50, RA4176-50, RA4180-50, RA4184-50, RA4188-50, RA4192-50, RA4196-50, RA4200-50, RA4204-50, RA4208-50, RA4212-50, RA4216-50, RA4220-50, RA4224-50, RA4228-50, RA4232-50, RA4236-50, RA4240-50, RA4244-50, RA4248-50, RA4252-50, RA4256-50, RA4260-50, RA4264-50, RA4268-50, RA4272-50, RA4276-50, RA4280-50, RA4284-50, RA4288-50, RA4292-50, RA4296-50, RA4300-50, RA4304-50, RA4308-50, RA4312-50, RA4316-50, RA4320-50, RA4324-50, RA4328-50, RA4332-50, RA4336-50, RA4340-50, RA4344-50, RA4348-50, RA4352-50, RA4356-50, RA4360-50, RA4364-50, RA4368-50, RA4372-50, RA4376-50, RA4380-50, RA4384-50, RA4388-50, RA4392-50, RA4396-50, RA4400-50, RA4404-50, RA4408-50, RA4412-50, RA4416-50, RA4420-50, RA4424-50, RA4428-50, RA4432-50, RA4436-50, RA4440-50, RA4444-50, RA4448-50, RA4452-50, RA4456-50, RA4460-50, RA4464-50, RA4468-50, RA4472-50, RA4476-50, RA4480-50, RA4484-50, RA4488-50, RA4492-50, RA4496-50, RA4500-50, RA4504-50, RA4508-50, RA4512-50, RA4516-50, RA4520-50, RA4524-50, RA4528-50, RA4532-50, RA4536-50, RA4540-50, RA4544-50, RA4548-50, RA4552-50, RA4556-50, RA4560-50, RA4564-50, RA4568-50, RA4572-50, RA4576-50, RA4580-50, RA4584-50, RA4588-50, RA4592-50, RA4596-50, RA4600-50, RA4604-50, RA4608-50, RA4612-50, RA4616-50, RA4620-50, RA4624-50, RA4628-50, RA4632-50, RA4636-50, RA4640-50, RA4644-50, RA4648-50, RA4652-50, RA4656-50, RA4660-50, RA4664-50, RA4668-50, RA4672-50, RA4676-50, RA4680-50, RA4684-50, RA4688-50, RA4692-50, RA4696-50, RA4700-50, RA4704-50, RA4708-50, RA4712-50, RA4716-50, RA4720-50, RA4724-50, RA4728-50, RA4732-50, RA4736-50, RA4740-50, RA4744-50, RA4748-50, RA4752-50, RA4756-50, RA4760-50, RA4764-50, RA4768-50, RA4772-50, RA4776-50, RA4780-50, RA4784-50, RA4788-50, RA4792-50, RA4796-50, RA4800-50, RA4804-50, RA4808-50, RA4812-50, RA4816-50, RA4820-50, RA4824-50, RA4828-50, RA4832-50, RA4836-50, RA4840-50, RA4844-50, RA4848-50, RA4852-50, RA4856-50, RA4860-50, RA4864-50, RA4868-50, RA4872-50, RA4876-50, RA4880-50, RA4884-50, RA4888-50, RA4892-50, RA4896-50, RA4900-50, RA4904-50, RA4908-50, RA4912-50, RA4916-50, RA4920-50, RA4924-50, RA4928-50, RA4932-50, RA4936-50, RA4940-50, RA4944-50, RA4948-50, RA4952-50, RA4956-50, RA4960-50, RA4964-50, RA4968-50, RA4972-50, RA4976-50, RA4980-50, RA4984-50, RA4988-50, RA4992-50, RA4996-50, RA5000-50, RA5004-50, RA5008-50, RA5012-50, RA5016-50, RA5020-50, RA5024-50, RA5028-50, RA5032-50, RA5036-50, RA5040-50, RA5044-50, RA5048-50, RA5052-50, RA5056-50, RA5060-50, RA5064-50, RA5068-50, RA5072-50, RA5076-50, RA5080-50, RA5084-50, RA5088-50, RA5092-50, RA5096-50, RA5100-50, RA5104-50, RA5108-50, RA5112-50, RA5116-50, RA5120-50, RA5124-50, RA5128-50, RA5132-50, RA5136-50, RA5140-50, RA5144-50, RA5148-50, RA5152-50, RA5156-50, RA5160-50, RA5164-50, RA5168-50, RA5172-50, RA5176-50, RA5180-50, RA5184-50, RA5188-50, RA5192-50, RA5196-50, RA5200-50, RA5204-50, RA5208-50, RA5212-50, RA5216-50, RA5220-50, RA5224-50, RA5228-50, RA5232-50,

73 Amateur Radio Today

Subscribe now!

☐ Yes! Send me 12 issues of 73 Magazine at the low rate of \$19.97. (Save 43% off the cover price.) ☐ Bill me

☐ AE ☐ MC ☐ VISA ☐ Payment Enclosed
Card# _____

Exp. Date _____

JULY 1992

Name _____

Address _____

City _____

State _____

Zip _____

Canada add \$7.00 plus \$1.40 GST;
Foreign add \$19.00 surface, \$42.00 airmail.

This card valid until August 31, 1992
in the U.S. and possessions.

You make the 73 supporting advertisers
very happy when you're interested in them.
... Wayne

READER SERVICE

1	2	3	4	5	6	7	8	9	10	151	152	153	154	155	156	157	158	159	160
11	12	13	14	15	16	17	18	19	20	161	162	163	164	165	166	167	168	169	170
21	22	23	24	25	26	27	28	29	30	171	172	173	174	175	176	177	178	179	180
31	32	33	34	35	36	37	38	39	40	181	182	183	184	185	186	187	188	189	190
41	42	43	44	45	46	47	48	49	50	191	192	193	194	195	196	197	198	199	200
51	52	53	54	55	56	57	58	59	60	201	202	203	204	205	206	207	208	209	210
61	62	63	64	65	66	67	68	69	70	211	212	213	214	215	216	217	218	219	220
71	72	73	74	75	76	77	78	79	80	221	222	223	224	225	226	227	228	229	230
81	82	83	84	85	86	87	88	89	90	231	232	233	234	235	236	237	238	239	240
91	92	93	94	95	96	97	98	99	100	241	242	243	244	245	246	247	248	249	250
101	102	103	104	105	106	107	108	109	110	251	252	253	254	255	256	257	258	259	260
111	112	113	114	115	116	117	118	119	120	261	262	263	264	265	266	267	268	269	270
121	122	123	124	125	126	127	128	129	130	271	272	273	274	275	276	277	278	279	280
131	132	133	134	135	136	137	138	139	140	281	282	283	284	285	286	287	288	289	290
141	142	143	144	145	146	147	148	149	150	291	292	293	294	295	296	297	298	299	300

Where did you get this copy of 73?

999A ☐ newsstand B ☐ subscription

FREE INFORMATION READER SERVICE CARD

Reader Service: To receive more information on the products advertised in this issue of 73, circle the appropriate number. Please allow 6 weeks for processing of inquiry. Offer valid in the U.S. and possessions for a limited time only.

Radio Fun

Subscribe Now! 12 issues for \$12.97

___ YES! Send me one year (12 issues) of *Radio Fun* for the low price of \$12.97.

For instant service call toll free 1-800-257-2346 (In New Hampshire, call 603-525-4201).

Name _____

(Please print)

Call _____

Address _____

City _____

State _____

Zip _____

Charge my: ☐ MC ☐ Visa

☐ Payment enclosed

Card number _____

Exp. date _____

Class License _____ Year Licensed _____ 73 Subscriber _____ QST Subscriber _____ CQ Subscriber _____

Canada add \$8. Foreign add \$12 surface, \$36 airmail. Newsstand rate \$24. Basic subscription rate \$14.97.

O4J



Place
Stamp
Here

73 Amateur Radio Today

READER SERVICE MANAGEMENT DEPARTMENT
P.O. BOX 8569
BOULDER CO 80329-8569



BUSINESS REPLY MAIL

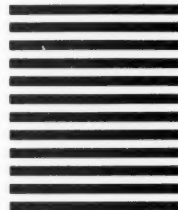
FIRST CLASS

PERMIT NO 211

MANCHESTER NH

POSTAGE WILL BE PAID BY ADDRESSEE

NO POSTAGE
NECESSARY
IF MAILED
IN THE
UNITED STATES



Radio Fun

PO Box 4926
Manchester NH 03108-9839



ADVERTISERS

R.S.#	page	R.S.#	page	R.S.#	page	R.S.#	page
164	Ace Communications of Indianapolis.....83	257	Delta Research.....75	64	Mouser Electronics.....17	250	Software Systems.....77
•	Advanced Electronic Application .9	19	Doug Hall Electronics.....31	141	Namulu Communications.....45	244	Software Systems.....66
67	* Alinco Electronics.....35	•	Down East Microwave.....17	223	National Amateur Radio.....52	158	Solder World.....60
194	All Electronics Corporation.....61	114	E. H. Yost.....29	54	NCG.....81	183	Spectrum International.....66
•	* Amateur Electronics Supply.....39	9	EasyTech.....47	44	Network QSL Cards.....45	•	Spy Supply.....78,85
•	* Ampire, Inc.....45	•	Eavesdropping Detection.....61	78	North Olmsted Amateur Radio.....77	247	Startek.....33
89	Antennas West.....15	8	Elktronics.....45	161	NX2P Electronics.....15	232	TE Systems.....15
107	Antennas West.....71	•	Emcom Industries.....52	82	Oak Hills Research.....71	149	Technitron America.....72
296	Antennas West.....65	•	Gap Antenna Products.....55	•	Oklahoma Comm Center.....67	•	The Ham Center.....23
135	Antennas West.....72	•	Get-Tech.....45	102	ONV Safety Belt.....83	131	The Ham Station.....49
5	Antennas West.....23	193	* GGTE.....45	172	Optoelectronics.....11	150	The Radio Works.....72
236	Antennas West.....61	72	Glen Martin Engineering.....17	262	Outbacker Antenna Sales.....71	62	TNR.....66
16	Astron Corporation.....25	192	Grapevine Group.....67	196	Overview Systems.....77	299	Townsend Electronics.....65
21	B & B, Inc.....72	57	Hamtronics, Inc.....51	•	P.C. Electronics.....58,81	22	Tri-Ex.....68
41	Barry Electronics Corporation.....19	284	Heights Tower Systems.....29	264	Palomar Telecom.....69	166	Trionics.....83
74	Bestway Systems.....71	179	* Icom.....CV2	139	Palomar Telecom.....23	190	U.S. Digital.....23
42	Bilal Company.....72	293	Innotek, Inc.....65	•	Pauldon.....72	•	* Universal Radio.....23
168	* Buckmaster Publishing.....67	100	Interconnect Specialists.....37	68	Periphex.....75	163	Urban Antennas Inc.....23
56	* Buckmaster Publishing.....61	77	Interflex Systems.....65	•	Personal Database.....49	•	Vanguard Labs.....52
7	* Buckmaster Publishing.....65	42	Isotron.....72	249	Phillips-Tech.....72	78	Vector Control Systems.....23
170	* Buckmaster Publishing.....71	270	J-Com.....83	49	Polyphaser.....16	14	VHF Communications.....31
222	Byers Chassis Kits.....77	159	Japan Radio.....43	132	Quement Electronics.....55,68	278	Virginia Beach Hamfest.....79
184	C & S Sales, Inc.....37,61	•	K-Comm.....23	147	R.L. Drake Company.....64	104	Vis Study Guides, Inc.....72
•	CB City International.....61	2	Kawa Productions.....77	110	Radio Amateur Satellite.....52	191	W & W Associates.....37
123	CCTV.....58	234	Kenwood USA Corporation .5,CV4	58	Radio Engineers.....72	20	Wolfe Communications.....52
265	Chipswitch.....65	47	Lentini Communications.....69	279	RAI Enterprises.....72	•	Yaesu Electronics Corporation.....6,CV3
186	Coaxial Dynamics.....75	25	Link-Com.....45	34	* Ramsey Electronics.....21		
156	Commpute Corporation.....77	86	Madison Electronic Supply.....77	142	Ready-Pak Systems.....23		
99	Communication Concepts, Inc.....15	162	MFJ Enterprises.....13	134	Rose.....65		
10	* Communication Specialist.....41	160	Michigan Radio.....31	254	Ross Distributing.....71		
121	Communications Electronic.....27	144	Micro Computer Concepts.....77	71	Rutland Arrays.....72		
12	Connect Systems.....1	30	Micro Control Specialties.....49	53	* Satellite City.....83		
146	Creative Control Products.....71	114	Micro Video Products.....45	167	Scrambling News.....72		
			Mr. Nicad.....29		Sescom, Inc.....83		

Bold listings are 73's new advertisers this month.

* Advertisers who have contributed to the National Advisory Committee (NIAC).



Radio Fun

“The beginner’s guide to the exciting world of amateur radio.”

Radio Fun is packed full of information to help you get more fun out of amateur radio. Basic “how-to” articles will get you up and running on packet, ATV, RTTY, DXing, and the dozens of other activities that make amateur radio such a great hobby. You’ll get equipment reviews geared toward the newcomer. We’ll help you upgrade to a higher class license with monthly columns designed to teach you what you need to know in a fun and exciting way. You’ll find it all, and more, in the pages of *Radio Fun*.

Don’t wait another minute. Subscribe today for only \$12.97 for one year. That’s 12 issues of the only ham radio magazine that is geared especially for the newcomer, or any ham who wants to get more fun and excitement out of amateur radio—*Radio Fun*!

12 issues for only \$12.97

1-800-257-2346

☐ **YES! Sign me up right now!** 12 issues of *Radio Fun* for \$12.97.

NAME _____ CALL _____

ADDRESS _____

CITY _____ STATE _____ ZIP _____

Check _____ MC _____ Visa _____

CARD # _____ EXPIRES _____

Class License _____ Year licensed _____ 73 Subscriber _____

QST subscriber _____ CQ Subscriber _____

Mail to: *Radio Fun*, P.O. Box 4926, Manchester, NH 03108

[Or call 800-257-2346 (in NH call 625-1163), FAX: 603-669-2835]

Canada add \$7.00 plus .70 GST. Foreign add \$12.00 surface, \$36.00 airmail. Newsstand Rate \$18.00. Basic Subscription Rate \$14.97.

O4L

NEW PRODUCTS

Number 21 on your Feedback card

Compiled by Hope Currier



EEB

Lowe receivers are now available in the U.S. and Canada. The new compact, go-anywhere HF150 is rugged, portable and performs like a giant. It covers 30 kHz to 30 MHz, AM, AMN, USB and LSB, plus four AM synchro detection modes. It also includes 60 memories, a large LCD readout, 10-15 VDC, 150 mA operations. Available options: keypad, NiCds (8-AA), whip

antenna, 120 VAC adapter. This unit is a great companion for a QRP field operation. It's just 7.3" x 3.2" x 6.3", weighs 2.9 pounds, and comes in a rugged metal alloy case.

For the price and more information on the Lowe HF150, contact EEB, 323 Mill Street N.E., Vienna VA 22180; (703) 938-3350, (800) 368-3270, Fax: (703) 938-6911. Or circle Reader Service No. 201.

PERIPHEX

Periphex has announced longer operating time, higher capacity, lower cost batteries for popular ICOM, Kenwood and Yaesu handhelds. For ICOM models, the BP-112S (7.2 volts, 800 mAh) offers a 15% increase in operating time at low power; the BP-114S (7.2 volts, 1700 mAh) offers a 45% increase at low power; and the BP-115S (12 volts, 800 mAh) offers a 100% increase at 5 watts output. The BP-112S is \$45; the BP-114S and the BP-115S are \$79 each. For Kenwood models, the PB-13S (7.2 volts, 1200 mAh) offers a 60% increase in operating time at low power, while the PB-14S (12 volts, 400 mAh) offers a 33% increase at 5 watts output. The PB-13S is priced at \$49.75 and the PB-

14S is \$60. For Yaesu models, the FNB-26S (7.2 volts, 1400 mAh) offers a 40% increase in operating time at low power, while the FNB-27S (12 volts, 800 mAh) offers a 33% increase at 5 watts output. Both Yaesu batteries are priced at \$65 and are 3.75 inches tall.

All battery packs include overcharge over-temperature and short circuit protection, and a one-year warranty. They are completely compatible with appropriate chargers. For more information, contact Periphex, Inc., 115-1B Hurley Road, Oxford CT 06478; (203) 264-3985, (800) 634-8132, Fax: (203) 262-6943. Or circle Reader Service No. 202.

SGC

The SG-2000 HF SSB from SGC is an American-made, remote-control head, full-coverage transceiver providing global HF communications on voice and data. The SG-2000 features scanning capability, a large LCD frequency display and ARQ/FEC capabilities. The Model SG-2000 is a solid commercial HF SSB transceiver which incorporates unique features appealing to the commercial, military, marine and amateur markets. It produces 150 watts and operates on the 1.8 to 30 MHz frequency bands. It is operational in voice and data transmission, has CW with sidetone, and is remote ready. The unit has all functions built in for HF SSB operation, including remote capability (up to 8 remote stations) through telephone lines. It can

be controlled by an IBM or compatible computer without its removable front panel. Designed with a direct entry VFO and 644 ITU channels, plus 100 user-defined memories, the SG-2000 will operate on all marine, commercial and ham frequencies and includes receive capabilities for broadcast, short-wave broadcast and weatherfax frequencies. A unique suction cup mount system allows the SG-2000 control head to be installed on a vehicle dashboard without drilling holes.

The retail price for the SG-2000 HF SSB radiotelephone is \$1995. For more information, contact SGC Inc., SGC Building, 13737 S.E. 26th St., Bellevue WA 98005; (206) 746-6310, Fax: (206) 746-6384. Or circle Reader Service No. 203.

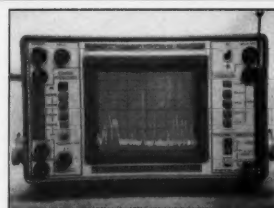
LINK PLUS

Link Plus Corporation has announced that, for the first time, its unique and powerful Link-Plus® signal processing technology will be made available to amateur radio operators in a new product called the MULE™. The MULE, or Multi-Use-Link-Enhancer, is a rugged, stand-alone unit that can be connected quickly and easily to any amateur radio with external cables. It is designed to allow amateur radio operators to quickly upgrade the voice quality of their radio systems without changing existing radio equipment, and without having to upgrade power and antenna systems.

The Link-Plus technology that is the heart of the MULE is an advanced, compact and cost-effective version of the linked compressor and expander

technology originally developed by the telephone industry to improve the quality of high frequency radiotelephone communications. The MULE greatly improves the "quality" of voice communications in the 2-30 MHz frequency range by eliminating all interference, channel noise and signal fade from the radio link and by significantly boosting the effective strength of the radio signal. The MULE's technology has been extensively tested and has been incorporated into both international and U.S. government HF radio performance standards.

For the price and more information, contact Link Plus Corporation, 9052 Old Annapolis Road, Columbia MD 21045; (301) 982-1585, Fax: (410) 997-3485. Or circle Reader Service No. 204.



ITC INSTRUMENTS

The SA1000 1000 MHz analyzer from Instruments Technology Corp. is a stand-alone, full-function 1 GHz spectrum analyzer with a dynamic input range greater than 115 dB. The SA1000 has a three-step 40 dB attenuator, a baseline clipper, and a push-button frequency selector for excellent center frequency accuracy. A DC to 50 MHz per division push-button disper-

sion control gives you a full 80 dB on-screen dynamic range from DC to 50 MHz dispersion settings with no degradation in the on-screen dynamic range.

The suggested retail price is \$1695. For more information, contact ITC Instruments, 3678 Mt. Ariane Dr., San Diego CA 92111; (619) 277-4619, (800) 232-3501. Or circle Reader Service No. 205.

POLYPHASER

The newly formatted 1992/1993 PolyPhaser product catalog of lightning arrestors and grounding devices is now available. This edition contains new products and a revised "Lightning Protection Information" appendix. Pricing is included. To request a copy,

contact PolyPhaser Corporation, Customer Service Department, P.O. Box 9000, Minden NV 89423-9000; (800) 325-7170. Or circle Reader Service No. 206.

PLANNED PRODUCTS

Planned Products has introduced a new version of the popular 2200 Circuit Works Conductive Pen. The new Micro Tip Circuit Works Conductive Pen incorporates an improved tip design and enhanced silver conductor for drawing fine-line silver traces with increased precision and control.

The new pen is used primarily to repair conventional and surface-mount circuit boards and is well suited for use on membrane and flexible circuit technologies. The improved Micro Tip design uses an easy-flow, no-clog tip for drawing precise conductive silver traces in electronic design, prototype and repair applications, including trace repair, circuit modification and component shielding.

It uses an improved silver conductor featuring the better conductivity and adhesion required by demanding design, prototype and repair applications.

The silver conductor dries in five to ten minutes at room temperature and reaches maximum air dry conductivity in 20 minutes. Repairing a typical damaged circuit trace requires 15 minutes and shows resistance of 0.01 ohms or less after the repair. Maximum conductivity and adhesion occur after a heat cure of between 250-300°F (121-149°C) for five minutes. Heat-cured silver conductor can be soldered at temperatures below 350°F (177°C) using tin, lead or silver solder. The new silver conductor is safe for circuit plastics and metals including copper, solder and solder mask.

The suggested retail price is \$10.95. For more information, contact Planned Products, 303 Potrero Street, Suite 53, Santa Cruz CA 95060; (408) 459-8088, Fax: (408) 459-0426. Or circle Reader Service No. 207.

REMEMBER... A LOW COST POWER PACK
WITHOUT PERIPHEX'S QUALITY IS NO BARGAIN

PERIPHEX POWER PACKS FOR
**LONGER
QSO TIME**



SUPER PACKS FOR ICOM 2/4SAT, 24AT & W2A



BP-83S 7.2V 750mah
\$43.50
BP-84 7.2V 1000mah
\$57.00
BP-84S 7.2V 1400mah
\$63.00
BP-85S 12V 800mah
\$76.00
BP-114S 12V 800mah
\$79.00

SAVE ON THESE POPULAR
PERIPHEX POWER PACKS
BP-7S 13.2V 1200mah ... \$65.00
BP-8S 9.6V 1200mah ... \$65.00

CALL FOR OUR SPECIAL OFFERS



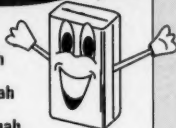
GREAT
YAesu VALUES!

FNB-2 10.8V 500mah
\$22.50
FNB-12 12V 500mah
\$45.95
FNB-14S 7.2V 1400mah
\$59.75
FNB-26 7.2V 1000mah
\$60.00
FNB-27S 12V 800mah
\$65.00

NEW BATTERIES AVAILABLE. CALL!

KENWOOD

PB-8S 12V 800mah
\$59.00
PB-13S 7.2V 1200mah
\$49.75
PB-25/26S 8.4V 900mah
\$65.00



Manufactured in the U.S.A. with matched cells, these
Super Packs feature short circuit and overcharge protection,
and a 12 month warranty. All inserts and packs in stock
or available from authorized dealers.

CALL US TO DISCUSS YOUR BATTERY REQUIREMENTS.



Add \$4.00 S & H FOR FIRST BATTERY. \$1.00 FOR EACH ADD'L
BATTERY - U.S. ONLY. Connecticut residents add 6% tax.

PERIPHEX inc.

115-18 Hurley Road, Oxford, CT 06478

800-634-8132

In Connecticut 203-264-3985 - FAX 203-262-6943

CIRCLE 68 ON READER SERVICE CARD

DELTACOMM™ DSS

Digital Signal Strength Option For Your ICOM™ R7000

DELTACOMM I-7000 and your MS-DOS computer gives you a custom interface integrated
with optimized software that will not just control but will maximize the potential of your R7000.

☐ CYBERSCAN function allows scan file tracking control of
systems employing frequency hopping techniques.

☐ Spectrum log at speeds in excess of 1300 channels/min.
while automatically generating a histogram of activity.

☐ Birdie log during frequency search automatically
characterizes your R7000, then locks out those frequencies.

☐ Automatic detection and storage of active frequencies during
search and spectrum log operations.



DELTACOMM DSS (Digital Signal Strength) upgrade for the DELTACOMM I-7000 communication manager.

☐ Innovative interface design allows digitizing and storing the R7000 signal level information with 8-bit
accuracy via your computer's game port.

☐ DSS allows user programmable upper and lower signal level detection limits during DELTACOMM I-7000's
spectrum log function.

☐ Log signal strength information to printer or disk file while DELTACOMM I-7000 is scanning.

DELTACOMM I-7000 communication manager program includes all cabling, manual, UL listed
power supply and Delta Research custom interface for \$299.00 + \$8.00 (U.S.) or \$25.00 (foreign)
S&H. The DELTACOMM DSS interface upgrade comes complete with easy to follow NO SOLDER
installation instructions, all cabling and 8-bit DSS A/D converter module for \$99.00 + \$8.00 (U.S.)
or \$25.00 (foreign) S&H and is available as an upgrade option to registered I-7000 users.

Master Card

Delta Research

AMERICAN
EXPRESS

Box 13677 - Wauwatosa, WI 53213 - FAX/Phone (414) 353-4567

CIRCLE 257 ON READER SERVICE CARD

Measure Up With Coaxial Dynamics Model 81000A RF Directional Wattmeter

Model 81000A is a thoroughly engineered, portable, insertion type wattmeter
designed to measure both FWD/RFL
C. W. power in Coaxial transmission lines.
81000A is comprised of a built-in line
section, direct reading 3-scale
meter protected by a shock-proof
housing. Quick-match connectors,
plus a complete selection of plug-in
elements, gives the FRONT RUNNER
reliability, durability, flexibility
and adaptability with a two year
warranty.

Contact us for your nearest
authorized Coaxial Dynamics
representative or distributor in
our world-wide sales network.



COAXIAL
DYNAMICS,
INC.

15210 Industrial Parkway
Cleveland, Ohio 44135
216-267-2233
1-800-COAXIAL
Fax: 1-216-267-3142



Service and Dependability... A Part of Every Product

CIRCLE 186 ON READER SERVICE CARD

NEVER SAY DIE

Continued from page 4

person—and so am I—and so are a hundred thousand other 73 readers. One thing I think you do recognize: If a hundred thousand people decide they're going to do something, the chances are pretty good they're going to get something done. And if you'll take the time and effort to convince just one other person, that's two hundred thousand—and we have a movement.

"Do It Yourself" Reviews

The next time you buy a piece of ham equipment, how about keeping notes on your experience and sharing it with the 73 readers? I'd like to know what your experience is when you get something new. I'd like to know what problems you have with it—what fun you've had—how you've solved the problems—how difficult or easy it was to get going—what information sources you've found to help—what accessories—you know, all the things you'd tell a friend.

What kind of equipment? My interests are the same as yours—I want to know about anything you buy—a transceiver, an HT, a packet unit—heck, even information resources. Before I make a buying decision on something I'd like to know a little more than I can find in the ads, or even equipment reviews. With so many competing products, I'd like to have the benefit of other people's experience.

I've just started a new publication in the music field which is based primarily on the readers sending in their reviews of the CDs they've bought. I want to know when a reader finds a CD which they think is great—and when they are disappointed. In the past reviews have always been written by music professionals. Unfortunately, this has tended to result in pedantic exercises, aimed more at exhibiting the profound knowledge of the reviewer than in help for potential buyers.

Yes, this is likely to result in a lot of much less educated evaluations. Well, I'll take that into consideration when I read 'em—and I'll be looking for more than one review on newly released CDs. I don't go to the movies just on the advice of Siskel. I also pay attention to Ebert, Medved, Lyons, and other reviewers.

So if one opinionated user review of a new HT is thumbs down and another is thumbs up, I'll want to read more and find out what it was that influenced each of the reviewers. How much is a particular reviewer blowing things out of proportion? And if the equipment is something I've had experience with, I'll want to write and set the record straight.

The end result of all this should be to help us all buy new equipment with greater confidence. When I read about a chap who's just bought a 6

meter rig and is having a ball, I'm going to want to get one too. Ditto 2 meter SSB. But suppose we start seeing complaints about a new rig—should we sweep these under the table and hide them? I think the industry as well as the 73 readers will be much better off if complaints are aired. I know I'll have more confidence in what I'm reading as well as in the company which faces up to and solves problems.

So the next time you buy some ham gear keep notes on your experience and send me a letter telling me how it worked out. If you have problems, be honest about them. Let's not get into histrionics. Yes, of course I'll be in touch with the manufacturer to try and help resolve problems. So don't get mad; let's instead try to find out what went wrong and why, and get it fixed. Address your letters to Vox Pop, 73 Magazine, 70 Route 202 North, Peterborough NH 03458.

I'll be much more influenced in my buying by a few letters telling me how great something is than by a formal equipment review. It's fun to buy something new and get on the air with it. The main thing holding me back is a lack of information. So, when you find something that's particularly fun, start writing so you can share it with all of us.

An ARRL Proposal

The ARRL and W5YI have proposed that the volunteer examiners take over all Novice exams as well as those for higher license grades. Well, sure, why not, right? So what are the benefits? And what are the drawbacks?

The benefits are easy to see. The VECs will about double their take. It's more difficult to see any benefits to prospective Novices. So difficult that, even with my legendary imagination, I'm stumped. Of course, since no VEC is really interested in the fees, their main goal being to provide a service, doubling their business would just be a nuisance.

This system would make it far more difficult for Novices to get examined. The present arrangement makes it so any radio club can handle this. So let's scuttle this proposal. Please let the FCC know you think this is a bad idea.

KV4FZ Convicted!

Will Herb's conviction of phone call theft cool the mess on 14.313? Herb, the Chief of Police Communications on St. Croix, has been convicted of stealing and using telephone access codes while making over \$1,000 in long distance calls. Many of these calls, it turns out, were devoted to Herb's special amateur radio interest of trying to destroy our hobby. He and his group of mentally defective deviates must be congratulated on a bang-up job of trashing our 20 meter band.

The problem we have is that while it's pathetically easy for people to get



QSL of the Month

To enter your QSL, mail it in an envelope to 73, Wayne Green Inc., 70 Rte. 202-N, Peterborough, NH 03458. Attn: QSL of the Month. Winners receive a one-year subscription (or extension) to 73. Entries not in envelopes cannot be accepted.

ham licenses, it takes almost an act of Congress to take one away. There's something wrong with that whole concept. I don't think the founding fathers put anything in the Constitution guaranteeing us the right to a ham license. It's a privilege, not a right. Well, there are responsibilities that go along with privileges and the rest of us are hurting because we have no way to protect our privileges from being trashed.

Granted, there's not a lot that we as individual amateurs can do, and that adds greatly to our frustration level when we hear the crap we have to put up with. The thought that comes to my mind when I hear all this nonsense—when I hear the bad language and racial taunts on 75m—when I hear dirty jokes—is why isn't our only national amateur radio organization working with the FCC to do something about this? Well, I've been watching carefully, hoping to see some signs of even a faint interest in the problem. Nothing visible yet.

I keep wondering how many amateurs have asked their ARRL directors to take some action on the growing messes we are hearing on our bands. The directors are presumably visiting your clubs and are there for you to demand action. If there's been one single case anywhere in the whole country where one single amateur has stood up at a club meeting and asked a director to take action I have not seen it reported in any club newsletters, nor have I had letter one from anyone claiming to have asked. I can only surmise that no one really gives a damn. Oh, I hear hams bitching and kvetching about it, and many letters grumble to me about it, but I have yet to hear of any time anyone has actually done anything. So much for a sense of personal responsibility.

So what can be done? Well, keeping in mind that a ham ticket is a privilege, how about getting the FCC to institute a simple system for de-licensing offenders—something which

doesn't require hiring lawyers and going to court? Let's make it easy to rescind the privilege and stop considering the license as a right.

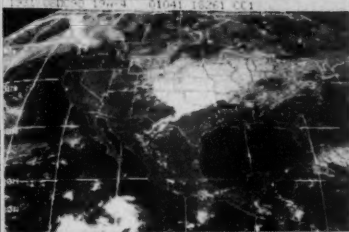
We need a system which we can run ourselves, without having to bring the FCC into the action. The less money we cost the FCC, the longer we'll be around. We know how to find hams causing intentional interference. We know how to tape the offenders. So let's empower our ham clubs to not only issue Novice licenses, but also to take away licenses.

We've been able to establish repeater councils and handle our own channel allocations, so why not set up a defrocking system? I'd suggest we establish area ham club councils to deal with this kind of mischief. If we let individual clubs have full say, we could run into problems with renegade clubs. Indeed, there are so many ham idiots in Southern California they probably could form several clubs. I don't think the bad guys outnumber the good guys yet—even there.

As you can see, when there are civil problems I tend to turn to the people for solutions, not to government or officials. The best rules we've had in amateur radio have been those we cooked up. The worst have been those from the FCC. I don't see any signs of that changing. And yes, the most disastrous of all, by a wide margin, have been promulgated by our own ARRL bureaucrats—like the 1963 Incentive Licensing disaster.

My apologies to any subliminally brainwashed ARRL members who find their bowels in an uproar over my admittedly rare mentions of that esteemed organization. The League has always promoted the concept that only League members have a right to criticize the League. Well, I've got my 50-year ARRL membership plaque, so I have every right, within the ARRL framework, to make suggestions and carp.

WEFAX To The Max



PC GOES/WEFAX 3.0 \$250

PC GOES/WEFAX 3.0 is a professional fax reception system for the IBM PC. It includes an AM/FM demodulator, software, cassette tutorial and 325 page manual. Check this partial list of our advanced features:

Res. up to 1280x800x256 APT Lat/Lon. Grids
Unattended Operation Orbital Prediction
Colorization Frame Looping
Zoom, Pan, Rotation PCX & GIF Export
Contrast Control Grayscale Printing
Tuning Oscilloscope Infrared Analysis
Photometry/Histograms Variable IOC & LPM

PC HF FACSIMILE 6.0 \$99

PC HF Facsimile 6.0 is a complete shortwave FSK fax system for the IBM PC. It includes an FSK Demodulator, software, 250 page manual and tutorial cassette. Call or write for a complete catalog of products.

Software Systems Consulting
615 S. El Camino Real, San Clemente, CA 92672
Tel: (714) 498-5784 Fax: (714) 498-0568

CIRCLE 250 ON READER SERVICE CARD

Say You Saw It in 73!

AMATEUR RADIO EQUIPMENT

CALL

Comm P I Inc.

800-942-8873

For Your Best Price

Authorized dealer for Icom, Kenwood, Yaesu, ASTRON, Belden, Bencher, AEA, Cushcraft, MFJ, RF Concepts, Hustler, Kantronics, Wilson, Diamond, Ham-10, Larsen, Wm. M. Nye, B&W, ARRL, Ameritron, Epson, Farr Corner, DTK

1057 East 2100 South, Salt Lake City, UT 84106
801-467-8873

CIRCLE 156 ON READER SERVICE CARD

All Aluminum

Chassis Kits Rack Shelves
Cabinet Kits Rack Equipment Cabinets
Assembled Cabinets Antenna Grounding Kits
Slope Box Kits Tower Mounted Box Kits
UHF & VHF Antenna
Power Divider Kits Other enclosures

Small sheets Aluminum and Brass

Byers Chassis Kits

Charles Byers K3IWK
5120 Harmony Grove Road, Dover, PA 17315
Phone 717-292-4901
Between 6PM and 9:30PM EST, Even.

CIRCLE 222 ON READER SERVICE CARD

MORSE CODE MUSIC?

Yes it's true! Now the morse code alphabet can be learned and enjoyed while doing aerobics, jogging, driving or dancing. Order "THE RHYTHM OF THE CODE" cassette single hit today!

Send \$5.95 check or money order
(please add \$2.00 S&H) to:

Kawa Productions

P.O. Box 319-ST
Weymouth, MA 02188
Mass Residents please add 5% sales tax
Dealer inquiries welcome

CIRCLE 2 ON READER SERVICE CARD

ATTENTION:

AEA-FAX USERS

Now you can receive and display weather FAX images directly from the satellites!

With:

• AMFAX-10 •

From:

OverView Systems

AMFAX-10 is a hardware AM to FM FAX converter designed especially for the *AEA-FAX package.

Features:

- Copy vivid polar orbiting, Geostationary, and GOES-TAP images.
- Easy to connect and use!
- Operates from 12 -14 VDC.
- Select original FM FAX or new AM FAX modes by the flip of a switch.
- Fully assembled and tested, just plug in...and go!
- Works with existing *AEA-FAX adapter and software.
- Cost: AMFAX-10 only \$99.95 plus \$6.00 shipping, optional 12 VDC adapter \$8.95.

To order send check or money order to:

For more info write
or call evenings &
weekends:

(305) 748-8315

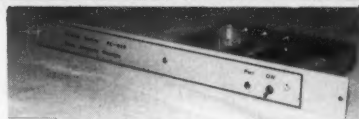
OverView Systems
P.O. Box 130014
Sunrise, FL 33313

* AEA-FAX is a TM of Advanced Electronic Applications, Inc.

CIRCLE 196 ON READER SERVICE CARD

RC-1000 REPEATER CONTROL

- Autopatch • Patch Re-encode Dialing
- Reverse Patch • User Programmable CWID & Codes • Intelligent CWID • Remote Base
- 3 Auxiliary Outputs • Complete Interface
- Control Rcvr Input • Programmable Tailbeeps • DTMF Decoder w/muting



42 Page Manual w/Schematics

Also - RC-1000: BASIC REPEATER CONTROL
w/Remote Base • User Programmable w/DTMF

RC-1000 Wired & Tested **\$239.95**
Optional Enclosure **\$59.95**



Micro Computer Concepts
7069-G2 Taylorsville Road • Dayton, OH 45424

513-233-9675



CIRCLE 160 ON READER SERVICE CARD

North Olmsted Amateur Radio
29462 Lorain Road
North Olmsted, OH 44070
216-777-9460



MIRAGE/KLM
Handi-Finder



Daiwa



Hustler



Diamond

AMERITRON®

many other items

CIRCLE 78 ON READER SERVICE CARD

MADISON SHOPPER

ORDERS: 1 (800) 231-3057
1 (713) 729-7300 or 729-8800
FAX 1 (713) 729-4766

New and Used Meters,
Tubes, Transformers,
Filter Capacitors
And More



FREE List Call



Madison Electronics
12310 Zavalla Street
Houston, TX 77085

CIRCLE 25 ON READER SERVICE CARD

Michael Bryce WB8VGE
2225 Mayflower NW
Massillon OH 44646

The Radio From Hell

I'm a beaten man. Yup! I'm not one to give up, but after a week and a half, you can stick a fork in me. I'm done! The reason for all of this is a simple direct conversion receiver slated for 10 MHz. Nothing really complex, just an NE602 and some 741 op amps. As it turned out, I created the radio from hell. On this project, I'm not a happy camper. Learn from my mistakes.

The problem started with the VFO. Using a MPF102 in a Colpitts oscillator seemed like a good idea at first. The output of my Colpitts oscillator feeds the NE602 mixer with more than enough output. Excessive injection can cause all manner of critters to come out of the NE602. A small value capacitor couples some of the VFO energy to the NE602. A T50-6 core and several small-value caps comprise the tuned circuit for the VFO. Now, I'm not one for re-inventing the wheel, so I used as my starting point the VFO from one of the projects in "W1FB's QRP Notebook." Using the values listed for 30 meters, I began winding coils and heating up the soldering

Low Power Operation

iron. I built the VFO first on a small piece of perfboard. Try as I might, I could not get the VFO to oscillate. Zero! Zip!

The silly thing would not even oscillate on the wrong frequency, let alone on the desired one. Out came the frequency counter and the oscilloscope. Try as I might, the oscillator still wouldn't fly.

The circuit is drawing current, so something had to be running. I checked the voltage on the drain of the MPF102 and, sure enough, I had the regulated voltage from the 7.5-volt zener diode. Yes, all the grounds were grounded and all seemed right with the world; but alas, no go.

A bad MPF102 must be the trouble. I replaced the MPF102 six different times. I gave up on number six as the chance of getting half a dozen bad FETs is a bit high. So, I started to replace the capacitors in the circuit. Again, nothing I did seemed to bring any life to the circuit. A desperate man, I scraped out the toroid and its capacitors from the circuit and in its place I installed a crystal cut for 10.106 MHz, one that should oscillate like mad.

Nothing but six zeroes on the counter. It was a little after three in the morning. The final score: VFO three, Mike zero.

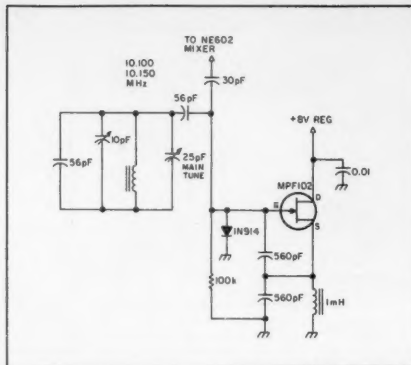


Figure. The oscillator from hell.

The Next Attempt

The next night (good thing I work 3-11 most of the time) I was back in the saddle again. All day long at work I had been working on the problem in my mind. And, as many have said, there is nothing up there to get in the way of an idea. I was out for blood, and the victim was the VFO.

My usual cut-and-try method was simply not cutting it (ouch)! I needed to get serious with Mr. Calculator. Out came the books, piles of books. If nothing else, perhaps I'd scare the oscillator into working. Look at the schematic in Figure 1. This is the beast I have been working on. The values listed are the ones I started out with.

Since I did not know the value of either the variable capacitor I was using, or the size of wire I wound the toroid with, Mr. Calculator was of little help. The variable capacitor looked as if it should be about 50 pF or so, and the wire looked close to #24 or #26 gauge.

It would seem to me that even if the component values were way off, the thing should still oscillate somewhere; but it didn't. So I started to remove components from the receiver. Perhaps I'd gotten a bad NE602? A shorted IC socket perhaps? I replaced the coupling capacitor several times thinking it might be bad. I also changed the values of the coupling capacitor. After awhile, I just removed it altogether and let the output of the VFO dangle there with my frequency counter probe attached.

Back using the cut-and-try method, I found (by changing out either C2 or C3 or both to 330 pF) I had a working VFO. The frequency oscillated from 9.500 MHz to 11.900 MHz. I could change the working frequency of the VFO slightly by spreading or compressing the turns on the toroid core.

Even though the VFO was operating, it was not a working unit. No matter what I did, I could not get smooth linear tuning from the VFO's main tuning capacitor. I could tune all the way from 9 MHz to over 12 MHz! This was all being done with a small 50 pF capacitor. The score for this evening: VFO four, Mike one.

I also found out that if I changed the values of C2 and C3 up or down ever so slightly, the oscillator would stop. One

would think the frequency would either be raised (by using smaller value capacitors), or be lowered (by using larger capacitors). I found out that such is not the case with this circuit.

One More Try

Really drawing for straws, I decided that the main VFO capacitor must be way off its marked value. Nope, I don't own (yet) a capacitance checker, so I started to pull out the rotor plates, one at a time. This would lower the overall capacitance of the tuning capacitor and thus give me more band spread. Maybe instead of 50 pF the capacitor was really 500 pF. When I got down to the last rotor plates, that theory went out the window: I had a variable capacitor with one rotor plate and still the frequency went from 9.98 MHz to over 11 MHz.

So I re-wound the toroid core by adding thicker wire and five fewer turns than I had before. I removed the small 10 pF trimmer capacitor in parallel with the main tuning capacitor—perhaps too much capacitance was causing the problem with the band spread. Well, that idea was way off base too. I had a VFO all right, but still not where I wanted it to oscillate. So, I tried padding down the tuned circuits by adding small capacitors in place of the trimmer. Using 10 pF caps, I kept adding them to lower the frequency of the VFO. Now instead of running at 9 MHz something to over 12 MHz something, I had it tuned between 6.8 and 7.7 MHz. Could it be I had it beaten? Well, Kenwood has their DSP, Ten-Tec their QSK and Yaesu their CAT system. I just developed VBFC, that's Variable Band Frequency Control. Yes Sir! All you have to do is start on the high end and turn her on. In no time you'll cover the entire 40 meter band in 50 Hz steps.

I connected the VFO to the NE602 and while I'm sitting here typing this, I'm listening to all of 40 meters all at the same time. Whoa! There goes CHU Canada. Sure wish they were on long enough so I could set the station clock. Perhaps during the next sweep I can set the clock.

So there you have it, two weeks down the tubes working on a VFO. Final score: VFO eight, Mike three. But as Arnold Schwarzenegger likes to say, "I'll

CELLULAR TELEPHONE MODIFICATION HANDBOOK

How are hackers making cellular phone calls for free?

- Techniques for decoding & changing cellular phones' NAMS & ESNS
- Where to buy programming devices
- The "roaming technique" scam!
- Chip supplier's phone numbers
- Instructions on how to change phone numbers on all models
- Cellular phone manufacturer's ESN codes



Complete Manual only \$79.95

M.O. or C.O.D. to
SPY Supply

7 Colby Court Suite 215

Bédford, NH 03110

(617) 327-7272

Sold for educational purposes only

RTTY LOOP

Number 23 on your Feedback card

Amateur Radio Teletype

Marc I. Leavey, M.D., WA3AJR
6 Jenny Lane
Baltimore MD 21208

Thanks To and From our Readers

I will start off this month by recognizing an anniversary. This column marks the start of the sixteenth year of "RTTY Loop." I don't know for sure, but I think this ranks up there with Wayne's "Never Say Die" column for longevity. All I can say about that is "thanks." Thanks to you, the readership, for your support and letters. Thanks to the crew at 73 for all their support and encouragement. Thanks to my family, for their understanding of this crazy hobby.

First of all, some follow-up on the column on America Online. When I checked, in late April 1992, the Kenwood file shown is available. Just look in the amateur radio files for the IBM PC compatibles. Also, I continue to be happy to forward your name to the service for starter software. Users of Macintosh or Apple II systems, please so indicate. Users of PC compatibles will need an EGA screen or better, mouse, and hard drive. Let me know the floppy disk size (5" or 3") you use.

Now, a message from Terry Stader KA8SCP/1, the America Online Ham Shack Host. He says, "It was nice to see the America Online's MS-DOS Ham Library graphic in the March 1992 issue of 73 *Amateur Radio Today*! Thanks for picking us out of the rest (Delphi and CompuServe) as one of the best bets. I think that the ham shack area is on the move with more and more personable interaction with the users than all of the other services combined! Our libraries are growing every day! Recently, a quick survey showed that many of our hams are interested in RTTY. Many of them know nothing about it . . . other than it is a mode that is available on the multi-mode TNC!"

Another member of America Online, Willie WD9FHA, passes along "a short note to let you know how much I enjoy 'RTTY Loop.' I read it every month. I am not on RTTY or packet yet. I have a Kenwood 7400A for 2 meters and a TS520S for HF. I am not sure the 520S would do very well on packet, but I may try 2 meters soon. I have a 286 clone so that will help." It's good to hear from both of these folks, and it points out how broad-based amateur radio communication has become. On and off the radio, we do get around!

Help Out a Hamsoft User

Now, turning from some of the latest communication to an orphaned machine, I have a letter here from Charlie Anderson KG5SX, of Hattiesburg, Mississippi. Charlie wonders if we have addressed the Kantronics Hamsoft cartridge for a Texas Instruments TI-99/4A computer.

He relates, "I have used one of

these for several years now, and it performs well and fills my bill for RTTY operation as I use a Heath HW-101 for 60 wpm RTTY and occasionally 100 wpm. My old Heath would not have the fast turnaround time required for AMTOR, so I am content to stay in the slow lane.

"Now I have a problem that I hope someone can help me with. It seems that I made a mistake in the shack one day and got 120 volts AC on the ground buss of my computer. Before the fuse blew the computer did, and took out part of the Hamsoft cartridge as well. The computer was easily enough replaced but I am having trouble locating another Hamsoft module. The cartridge may be OK, but [I am] not sure, as it locks up the computer when I try to use it. Sounds hopeless, but there is a chip in the cartridge that I do not have the number for, as the top of it is gone, and this chip appears to have taken the brunt of the shock. It is an SN74??? series chip. These are the only numbers readable on it and it is tied into the TMS9901 chip on the board. The ROM chip, which is marked HN482764, appears OK visually, but I know it may be permanently damaged.

"I called Kantronics and they said that they had nothing left on this device. No parts list. No schematic. They referred me to Dentronics and I called them and got the same reply. I have tried to locate a used cartridge via the 1-800 numbers, but have been unsuccessful so far. I really want to get this thing fixed or replaced, as it was on loan to me and I hate to tell my friend, 'Sorry about that, ole buddy!' I know it is a long shot, but hopefully the only thing wrong is the 14-pin DIP chip . . . and maybe the TMS9901, which I know where to locate. [Hopefully someone] can look inside [a Hamsoft cartridge] and tell me what the chip number in question is. Or perhaps there is someone out there who can clone me another ROM chip, as mine is QRT."

Well, the reader base of this column is one of the most complete in the RTTY universe, Charlie. So, if anyone has the information, please forward it here, or directly to Charlie. We all thank you!

By the way, reversing the AC line hot and ground wires can be more than damaging to computers; it can kill you. If you touch a chassis that you think is grounded, but is really at full line potential, while touching a real ground, the result could be a real silent key. One simple device which can help is a \$.95 Grounded Outlet Analyzer, available at your local Radio Shack (stock number 22-101). This handy little plug-in device has color-coded lamps to indicate whether or not the outlet is correctly wired. No, it may not be the equivalent of industrial testers costing hundreds of dollars, but it doesn't cost hundreds of dollars, either!

Packet Without a TNC

Interest in TNC-less packet is well articulated by many of you, with a common set of questions. David L. Ringo, M.D., N6UVF of Portola Valley, California, is one such interested party. Just finishing his psychiatry residency, Dr. David finds interest and intrigue in the different digital modes. "The possibility of putting together a very compact laptop/2 meter HT packet system is very attractive, but a number of questions come to mind. As I understand it, the BayCom and PMP ['Poor Man's Packet,' August 1991, 73] systems differ in that one uses the serial port and the other the printer port, so that one's modem would be incompatible with the other's software. What's the real scoop on TNC-less systems? Are they as effective as a TNC, and if not, what exactly are the trade-offs? Are there significant differences between the German and A & A BayCom modems? Do you have any recommendations as to suitable laptops? I would think that RFI from the computer would be a significant issue, but I haven't seen anyone address that."

First of all, I agree that a serial and parallel data flow are incompatible. This is not to say it has not been done, just that I don't think one modem will suffice for both systems. The TNC is, after all, a dedicated computer that performs all the functions necessary for packet communication. Your personal computer can do the same, but the overhead for managing local oper-

ations, video, disk access, printing, and the like, would all cut into packet time slices. I would say that for routine, straightforward packet work, the TNC-less systems may well be all the typical amateur needs. For more demanding work, to set up a digipeater or bulletin board, the efficiency of a dedicated TNC would be a requirement. As to the differences between BayCom modems, I can't say. I would invite users' comments, though, on the various implementations, and will pass them along in future columns.

Suitability of laptops hinges on several factors, but FCC Class B certification, attesting to the lower RFI levels for home computing, is an ABSOLUTE! Other than that, the best bet would be to stick with one of the national brands, and even with a local dealer who will allow you to return or exchange the machine if RFI is a problem. I don't yet own a laptop, or I would share my own experiences. Don't fret, though, my history of candor is that when I do pick up a new piece of hardware, I share the information with a few of my most trusted friends: YOU.

Next month, more from here and there, you and me. The one story I won't tell you is how a squirrel brought down my antenna (unless you really want to hear it). I continue to look forward to your input, both by mail and Email, via CompuServe (ppn 75036,2501), Delphi (username MarcWA3AJR) and America Online (screen name MarcWA3AJR).

17th Annual Va. Beach HamFest / Computer Fair™

ARRL Roanoke Division Convention

Sept 19 & 20, 1992
Va. Beach, VA



- ✓ Major Commercial Exhibitors & Dealers
- ✓ Amateur Exams & Upgrades
- ✓ Special Guest - Gordon West, WB6NOA
- ✓ DX Forums - Technical Forums
- ✓ Major Computer Dealers
- ✓ Excellent Food Service
- ✓ Held at the **Va. Beach Pavilion**
- ✓ Plenty of FREE Parking
- ✓ It's still Vacation Time at the Beach!
- ✓ Lots of Nearby restaurants, museums, historic sites - Williamsburg, Busch Gardens, Norfolk Naval Base & more!

General Admission - \$5 Advance - \$6 At The Door
Tickets Good for Both Days!

Tickets & General Info
Manny Steiner, K4DOR
3512 Olympia Lane
Va. Beach, VA 23452
(804) 340-6105

Send SASE - Checks
Payable to TRC, Inc.

Exhibitor Info
Lewis Steingold, W4BLO
3449 Dickens Drive
Va. Beach, VA 23452
(804) 486-3800

CIRCLE 275 ON READER SERVICE CARD

HAMS WITH CLASS

Number 24 on your Feedback card

Carole Perry WB2MGP
Media Mentors, Inc.
P.O. Box 131646
Staten Island NY 10313-0006

Invention Versus Innovation

If, as a teacher, you were given the following background information about one of your new students, what assumptions would you make about his abilities to be successful at anything?

"The doctor said he had brain fever at birth—having an extra large head. In fact, three brothers and sisters died at birth. Relatives and neighbors thought he was abnormal, but his mother said no. His teachers thought he was abnormal too, so his mother taught him at home. He was a firebug, setting a fire in the barn just to see what it would do. He had only three months of formal schooling."

As any good teacher can tell you, it's not a good idea to make any assumptions about any child's ability to succeed until you've had a chance to work with the student yourself. The fact is that the young man described above is Thomas Edison!

We who are teachers or instructors must be careful not to pre-judge anyone who sits before us. It is a truism of education that given the right environment and motivation, everyone is capable of doing at least a little better than his own expectations. I've been working with young people for almost 20 years, and I certainly believe that.

Those of us who are working hard to promote growth and quality in amateur radio know the value of encouraging newcomers to explore and experiment with different modes of communication. We who are in the classroom are in the position of being mentors who can actually teach children not to be afraid to take risks; not to be afraid to ask questions and to be curious; and most importantly, not to be afraid to fail.

While it is true that we're not all going

to have a Thomas Edison in our classes, we are all at least going to have some youngsters with the potential for being creative and innovative, if only given the chance. When you tap into someone's creative psyche and give them the tools they require to take a chance, you never know what great ideas, inventions or innovations you may be setting into motion.

The History of Invention and Innovation

Firstly, the children should understand the difference between invention and innovation. An *invention* is a brand-new and unique idea or discovery. An *innovation* is a concept that builds on a previous idea, invention or discovery, providing a new or perhaps improved solution.

Many thousands of years ago our ancestors found that daily living was a pretty rough experience. The caveman had only his hands to use for hunting, fishing, and gathering plants and roots. He had to find creative ways to protect himself and his family from the elements (the weather and the wild animals). Early man was forced by circumstances to use his brain and his hands to make things that would make his life easier and more pleasant. He invented tools for fishing, hunting and building. At first the tools were just sharpened stones. He soon discovered that fire was good for keeping warm and that water had many practical uses. The fur from wild animals proved to be valuable for warmth, so clothing was invented. Most likely it was a rolling rock or a cross section of a tree trunk that began to slide and roll which gave someone the idea for a wheel. One invention led to another. Many men thinking and inventing over a long period of time led to some of the inventions and innovations we have come to rely on today.

In prehistoric times there were no chairs. Our ancestors probably leaned against the cave wall or sat on a rock or a ledge. At some later date, the chair was invented. Since that time, thousands of dif-

ferent kinds of chairs have been designed. Today there are all kinds of chairs: folding chairs, rocking chairs, lounge chairs, couches, beach chairs, etc.; all these different kinds of chairs are innovations. They each meet a different need based on the original invention of the chair.

Teaching Techniques

A good activity to use in the classroom is to have students make a list of commonly used devices. Then have a discussion about which category each item belongs in—invention or innovation. A good follow-up to this is to divide the class into groups and have them brainstorm about one particular invention. It's sometimes helpful to have children work together in a group to get started with this kind of creative process. After they've researched all the background on a particular invention; like who the inventor was, why it was invented, what needs it met, when it was invented, etc.; they can make a list of possible innovations for the future. Children tend to be less inhibited with the creative work when working as a team. Besides, working as a team member is an important skill to master. Many inventions and innovations that are made nowadays are made by employees in large institutions who are part of a research team.

One year we turned an entire complex of rooms in our school into a living time line. Each room represented a different era of time in history. When a visitor walked into a particular room he was transported into a time warp. The children wore costumes of the time, served food of that period, and exhibited inventions of that era. What a fabulous activity this can be in a school! There were so many subtle lessons learned—like the fact that there were certain periods of time that were more conducive to the spirit of "inventing" than others. Why? The Time Line Fair lasted only three days, but the preparation for it took weeks, and the follow-up discussions and lessons went on all term. I strongly recommend that you include a living time line activity in your curriculum.

Another good activity to encourage creative thinking is to have the youngsters keep a diary over a period of time of all the needs and problems that they encounter.

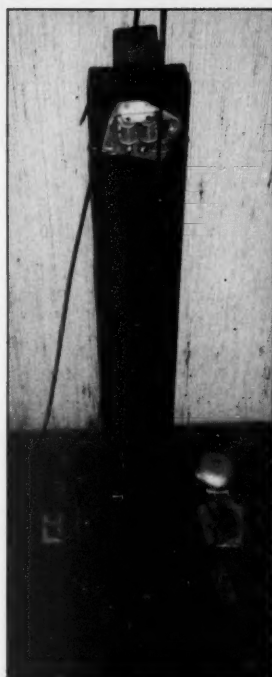


Photo B. This is the replica of the fire alarm W2SLP invented as a young boy.

Most inventions and innovations come about from a need or a necessity for change. Let each child pick a need or problem and lead a brainstorming session to see what kinds of solutions the rest of the class can come up with. You will be amazed at how productive these sessions can be. I even tape-record some of the more sophisticated topics so the children can refer back to the things that were discussed.

I'm a strong believer in bringing in experts who are good speakers to meet with the children in person. After you've laid the groundwork for the class's involvement with their own inventions, you might want to invite a patent attorney to visit



Photo A. Roger W2SLP testing circuit boards for a digital clock thermostat he invented.

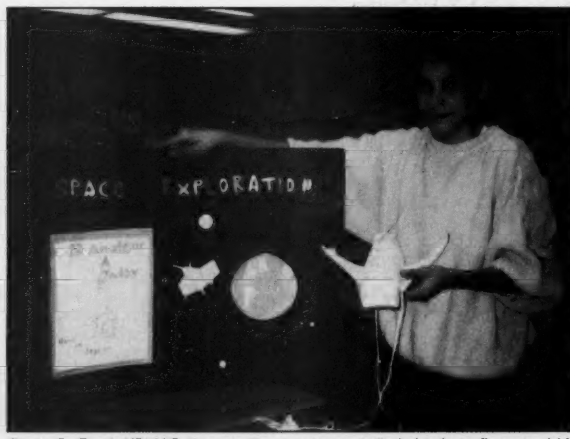


Photo C. Frank KB2MID "invented" a remote-controlled shuttle to fly around his space station. Carole WB2MGP encourages her students to be creative with their projects.

your school. Once the children get caught up in the spirit of "inventing" they will have a million questions for this kind of expert about what they can do next with their inventions.

Bring in Your Ham Friends

Think through your list of ham friends and you'll probably come up with someone who has tinkered with a new kind of gadget, invented a new gizmo or discovered a better process for doing something or other. Bring them in to speak with the kids. Let them share their thinking, their methodology, and most importantly, their enthusiasm with your students.

I'm lucky enough to know several hams who fit this bill. My good friend Roger Isaacs W2SLP owns an electronics manufacturing company on Staten Island. He is the inventor and patent holder of several terrific products, including an electronic clock thermostat, a wireless car alarm, and various versions of fire and burglar alarm systems for stores and houses.

Roger once took the time to recreate a project he created as a child for my class to see. As a youngster he thought up his own version of a simple fire alarm by building a "Rube Goldberg" kind of device. When you light a match under one of the wires, it releases a magnet which drops down to close a circuit which then enables the bell to ring. The kids love it!

Don't forget to include enrichment activities from the social studies curriculum. Many inventions greatly influenced the

course of history. Doing research on inventors throughout history is a valuable lesson. It can lead to discussions about how our lives might be different today without the work of people such as Guglielmo Marconi, Jonas Salk, Charles Goodyear, Louis Pasteur, Robert Goddard, Johann Gutenberg, or George Washington Carver, just to name a few.

Several months ago on our CQ All Schools Net, Jay Apt N5QWL, a NASA astronaut, was speaking with some 6th grade ham radio students of mine. He asked a youngster to go to the chalkboard and make a list of all the things the class thought should be part of the astronaut's spacesuit. This naturally triggered off all kinds of terrific discussions and research projects for weeks about space travel and astronauts and communications devices. What Jay was doing was setting the stage for this creative thinking we've been talking about.

My advice is to approach every class as though you believed there must be a future Thomas Edison amongst the children, who would emerge if only you could create the right atmosphere for him or her to flourish in. Amateur radio in the classroom makes this not only easy, but fun as well. Good luck, and let me know what your kids and you "discover."

A good resource to write to for more classroom ideas about inventing is "Invent America," 510 King Street, Suite 420, Alexandria VA 22314; or call (703) 684-1836.

AMATEUR TELEVISION

GET THE ATV BUG



**Transceiver
Only \$329
with 50 Watt
D26 Amp \$539**

Value + Quality
from over 25 years
in ATV...W6ORG

With our all in one box **TC70-1d**, ATV Transceiver, you can easily transmit and receive live action color and sound video just like broadcast TV. Use any home TV camera or VCR by plugging the composite video and audio into the front VHS 10 pin or rear phono jacks. Add 70cm antenna, coax, 13.8 Vdc and TV set and you are on the air - it's that easy!

TC70-1d has 1.5 Watt p.e.p. with one xtal on 439.25, 434.0 or 426.25 MHz & properly matches Mirage D15, D26, D100 amps for 15, 50, or 70 Watts. Hot GaAsfet downconverter varicap tunes whole 420-450 MHz band to your TV ch3. Shielded cabinet 7x7x2.5". Req. 13.8 VDC @ .5A

Transmitters sold only to licensed amateurs, for legal purposes, verified in the latest Callbook or send copy of new license.

Call or write now for our complete ATV catalog including downconverters, transmitters, linear amps, and antennas for the 400, 900 & 1200 MHz bands.

(818) 447-4565 m-f 8am-5:30pm pst.

Visa, MC, COD

P.C. ELECTRONICS

Tom (W6ORG)

2522-WG Paxson Ln Arcadia CA 91007

Maryann (WB6YSS)

Modern, High-Performance Stations use COMET Antennas, Duplexers, Triplexers and Accessories!

146/446 MHz Base/Repeater	COMET PRESTIGE 24 Kl. Gold Center Conductor		2x4 Series Best Sellers	NEW B Series Black Anodized	
CA-2x4WX Gain & Wave: 146MHz 5.5dB 446MHz 9.0dB 5/8 wave x 5 Max Power: 200 watts Length: 10' 2" Connector: UHF (SO-239)	CA-2x4FX Gain & Wave: 146MHz 4.5dB 446MHz 7.2dB 5/8 wave x 3 Max Power: 200 watts Length: 5' 11" Connector: UHF (SO-239)	CPR-5800 Gain & Wave: 146MHz 5.0dB 446MHz 7.6dB 5/8 wave x 3 Max Power: 120 watts Length: 5' Connector: UHF (PL-259)	CPR-5400 Gain & Wave: 146MHz 3.5dB 446MHz 6.0dB 5/8 wave x 2 Max Power: 120 watts Length: 3' 2" Connector: UHF (PL-259)	CA-2x4MB Gain & Wave: 146MHz 4.5dB 446MHz 7.0dB 5/8 wave x 3 Max Power: 150 watts FM Length: 4' 10" Connector: UHF (PL-259)	CA-2x4SR Gain & Wave: 146MHz 3.8dB 446MHz 6.2dB 5/8 wave x 2 Max Power: 150 watts FM Length: 3' 4" Connector: UHF (PL-259)
CA-2x4MAX Gain & Wave: 146MHz 8.5dB 446MHz 11.9dB 5/8 wave x 8 Max Power: 200 watts Length: 17' 8" Connector: UHF (SO-239)	B-20 NMO — With NMO Connectors Gain & Wave: 146MHz 2.15dB 446MHz 5.2dB 5/8 wave x 2 Max Power: 50 watts Length: 30" Connector: UHF (PL-259), OR NMO (B-20 NMO)		B-10 NMO — With NMO Connectors Gain & Wave: 146MHz 0dB 446MHz 2.15dB 1/2 wave Max Power: 50 watts Length: 12" Connector: UHF (PL-259), OR NMO (B-10 NMO)		

NCG
1275 N. Grove Street, Anaheim, CA 92806
(714) 630-4541 • (800) 952-2611
CALL FOR COMPLETE CATALOG OR NEAREST DEALER

CF-416A

CF-4160K

2M-70cm DUPLEXERS
Power: 146MHz 800W
446MHz 500W

CF-416A: All UHF Conns w/ Leads
CF-4160K: All UHF Conns w/o Leads
CF-4160K: Dingo, but 440 Input
N-male Conn. w/o Leads

CIRCLE 54 ON READER SERVICE CARD

Arnie Johnson N1BAC
43 Old Homestead Hwy.
N. Swanzey NH 03431

Notes from FN42

I have just come home from a very satisfying experience, seeing 38 non-hams show up for a meeting that was the start of a Novice/Technician class in Keene, New Hampshire. It was wonderful to see people of all ages, from the young to the more mature (we're never old, are we), male and female. My sons might have used the expression "AWE-SOME!"

There were also more than 10 licensed hams at the meeting, all willing to take time away from their families and friends to help in any way that they could to give a boost to the ham population in the Keene area. The syllabus has been laid out and many hams will take part in the teaching, not just one or two.

Something else that is very important is the location, the place where all the training will take place. One of the local hams is a member of the Army Reserve and he asked the powers that be if we could use the facilities of the local reserve unit for the ham training. We received approval from the local commander and things started happening.

How many of you have done the same thing in your area? How many of you have given something back to the hobby you love? How many of you have become an "elmer" to another person, a prospective ham? How many of you have read the Silent Key column in your favorite ham magazine or newsletter, shook your head, but have done nothing to replace the lost one with at least one more?

If your answer or answers to the previous questions lead in the direction of "Let someone else do it," or "I can't do it," you are now part of a very common problem: apathy—lack of feeling, emotion, excitement; indifference [courtesy

of Webster's Dictionary]. How about becoming a part of the solution to the decreasing ham population by getting involved locally in starting ham classes, either in the evenings at some convenient location or at some of your local schools? Many teachers/hams are doing it in schools in a very big way and doing it very well. It is a natural thing to do. We in the United States have been advised that our education system is sadly lacking in mathematics and science, and that we are last or almost last in that knowledge worldwide. Ham radio involves much more than just chatting on the radio waves. It includes many things: science, math, language, etc. What better way to help our young people learn than to get involved with them? Maybe we will learn something from them also. Let us ALL become part of the solution to the problem!

Hopefully all of you are now aware of the movement of the 73 offices back into Peterborough, New Hampshire. There is a new address and also new phone and FAX numbers. I'm sure that if you have sent something to the Hancock address it will make it to the new "digs."

As I am finishing this column I am in a hurry because I still have to pack my station wagon with all of the "treasures" that I am taking to the Deerfield Hosstraders Ham Fleamarket. The usual starting time is 4 p.m. on Friday, and the event usually ends about the same time on Saturday. As of 8 a.m. this Friday morning there are already people willing to pay a premium amount to enter the fairgrounds to get a good location. This is out in the open, under the trees. There are buildings available but usually only the dealers will rent space in them to set up their wares. I guess it is what you call a "happening."

Hopefully, many of you around the world have the same chance to attend such a happening. It is always great fun

to see people that you haven't seen since the last one or meet a person for the first time that you have been talking to on the air for many years.

Maybe you will be an elmer to some new ham and help that person in choosing a first rig. Do you remember your excitement with your first rig? I certainly do, and it is now time for all of us to see the delight in others' eyes as they carry it (drag it?) back to their car. As I mentioned before, become part of the solution to the dwindling numbers of hams in the world, **GET INVOLVED!**—Arnie N1BAC

Roundup

Netherlands Just received is the first edition of "On Target," a free publication designed to inform listeners about what is happening to the English language programs from Radio Netherlands. This newsletter is sent twice a year to listeners who have registered on the mailing list. Radio Netherlands is making a lot of changes to the format of its transmissions, bringing the presentation in line with a new style for the 1990s.

If you wish to receive this free publication send your name and address to: "On Target," Radio Netherlands, P.O. Box 222, 1200 JG Hilversum, The Netherlands; FAX: +31 35 724 352. If you have signal reports you wish to send, address them to Monitoring Panel OTR, Radio Netherlands Frequency and Monitoring Department, at the same address.

Scotland From John "Paddy" McGill GM3MTH: The Scottish Tourist Board (Radio Amateur) Expedition Group event for July is GB2SMC at the Scottish Museum of Communication, Bo'ness, July 18/19. [Check the May issue for frequencies and times.—Arnie]

United States/Nepal Information received on the packet system from Bob K1RB, 16 April 92, 0100Z: "Gary Olson KA9RLJ has confirmed that Father Marshall O. Moran 9N1MM passed away early today, at a hospital in Katmandu, Nepal. The sad news followed word that Father Moran was hospitalized by what was believed to be congestive heart failure several days ago. Father Moran

was often on the '256' net until recently. A member of the Jesuit order, Father Moran had friends all over the globe. From his station in Nepal he communicated with amateur radio stations worldwide. He made many trips to the United States, attending numerous amateur radio gatherings." [Father Moran will be sadly missed by all hams around the world.—Arnie]

United States/Ukraine From Mark Olesnicki N2DQS: On September 2, 1991, I made contact with a strange call-sign in what was at that time still part of the Soviet Union. The call-sign was RY75BL.

I inquired of the station, and found out that this was a Special Event Station in the Ukraine commemorating the 75th anniversary of battles between the Ukrainian Sith Army and the Tsarist Imperial Armies held at the site of this station atop the hill Lyson near the city of Berezhany in the Ukraine (Zone 16, Oblast 076).

Although they spoke English well, I switched to the Ukrainian tongue and had a wonderful QSO with the organizers of this Radio Expedition to the hill Lyson. It was organized by the Club Station UB4BYU, a group of young students at the local technical school. The club trains and inspires youngsters in the art of amateur radio and invites other groups such as Scouts, known as "PLAST" in the Ukraine, to participate. They slept in tents, ate food supplied by a field kitchen, and transmitted from transceivers powered by batteries or generators. This Field Day atmosphere inspired great camaraderie and a sense of pride and accomplishment for this group of young Ukrainians. As you may recall, the Ukraine had just announced its independence a short time before.

As one of the leaders, Ihor Hryczyszyn UB5BBN explained to me that the emphasis of this expedition to Lyson was on youth, their pride of national origin, and the hope of being recognized by their international peers. From August 30 to September 4, 1991, they had 4,500 QSOs with 92 countries.

To confirm and commemorate this QSO and event I received a beautiful diploma and several QSL cards, as well as personal letters and copies of newspaper articles describing the event.

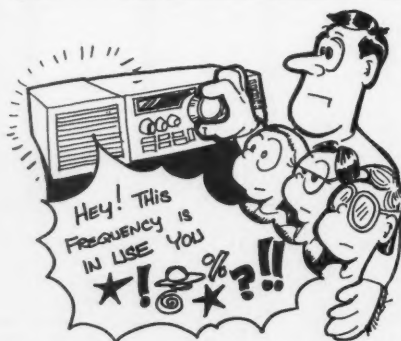
Today I received a letter from Ihor UB5BBN informing me that Special Event Station US76BL will be on the air from 0000UTC on August 28 through 2359 UTC September 2, 1992. The call stands for Ukraine Sovereign 76 Berezhany Lyson. The number 76 is for Oblast 076.

The organizers of this Special Event Station request that I notify anyone who could make it a resounding success. Operation will be on all bands and will include CW, SSB, RTTY, and SSTV. To receive a QSL and certificate of the event (Diploma), one must complete a successful QSO with US76BL and send a QSL card along with 5 IRCs to: Ukraine, 283150, Berezhany, Ternopilsk Obl., p/s 12 UB4BYU. [Mark T. Olesnicki, M.D., N2DQS, 9 Driftway, Florham Park, NJ 07932.]

HEART DISEASE

We're Making a Difference.

American Heart Association



While tuning around the band, Bill found it was not hard to hold the children's interest during the demonstration.

BARTER 'N' BUY

Number 26 on your Feedback card

Turn your old ham and computer gear into cash now. Sure, you can wait for a hamfest to try and dump it, but you know you'll get a far more realistic price if you have it out where 100,000 active ham potential buyers can see it than the few hundred local hams who come by a flea market table. Check your attic, garage, cellar and closet shelves and get cash for your ham and computer gear before it's too old to sell. You know you're not going to use it again, so why leave it for your widow to throw out? That stuff isn't getting any younger!

The 73 Flea Market, Barter 'n' Buy, costs you peanuts (almost)—comes to 35 cents a word for individual (noncommercial) ads and \$1.00 a word for commercial ads. Don't plan on telling a long story. Use abbreviations, cram it in. But be honest. There are plenty of hams who love to fix things, so if it doesn't work, say so.

Make your list, count the words, including your call, address and phone number. Include a check or your credit card number and expiration. If you're placing a commercial ad, include an additional phone number, separate from your ad.

This is a monthly magazine, not a daily newspaper, so figure a couple months before the action starts; then be prepared. If you get too many calls, you priced it low. If you don't get many calls, too high.

So get busy. Blow the dust off, check everything out, make sure it still works right and maybe you can help make a ham sure it still works right and maybe you can help make a ham newcomer or retired old timer happy with that rig you're not using now. Or you might get busy on your computer and put together a list of small gear/parts to send to those interested?

Send your ads and payment to the Barter 'n' Buy, Sue Colbert, 70 Rt. 202N, Peterborough NH 03458 and get set for the phone calls.

Deadline for the August classifieds is June 11, 1992.

HAM RADIO REPAIR CENTER, quality workmanship. Solid state or tube, all makes and models. Also repair HF amplifiers. A-Z Electronic Repair, 3638 East, Indian School Rd., Phoenix AZ 85018. (602) 956-3024. BNB220

FINALLY HEAR those unreadable signals buried in noise, heterodynes, tuner uppers. The **REVOLUTIONARY** new JPS audio filter NIR-10, digital signal processing, simple hook up, deep discounted \$379.00 delivered! Authorized dealer: Davis RF Co., P.O. Box 230-S, Carlisle MA 01741. 24-HR. Orders: (800) 484-4002, code 1356. BNB254

HENRY RADIO 3K CLASSIC AMPLIFIER 3.5 through 30 MHz. Amplifier is in showroom condition only 1 year old! All reasonable offers considered. Original cost \$2,700. If purchased must pick up yourself. Call Paul at (401) 272-4916. BNB433

QSL CARDS—Look good with top quality printing. Choose standard designs or fully customized cards. Request free brochure, samples (stamps appreciated) from Chester QSLs, 310 Commercial, Dept. A, Emporia KS 66801. FAX (316) 342-4705. BNB434

REVOLENER HYBRID AERIAL WIRE: 166-strand copper "FLEX-WEAVE" Tm, #14, strong, Ultra Flexible, ties in knots, non-stretch, won't rust/kink like copper weld, \$36.95 first 275' (minimum), \$13/ft. thereafter, includes shipping! Catalog \$1.00. DAVIS RF Co., P.O. Box 230-S, Carlisle MA 01741. (800) 484-4002, code 1356. BNB557

COAX, GROUND RADIAL WIRE, lowest cost, top quality, MilSpec RG-213, \$38/ft.; RG-8X, \$19; RG-58, \$18; LOW LOSS Belden equiv. RG-9913, \$39; any lengths. Radial wire #16, \$39.50/1000 ft. includes shipping! Immediate shipment. Catalog, \$1.00. DAVIS RF Co., P.O. Box 230-S, Carlisle MA 01741. (800) 484-4002, code 1356. BNB562

COMPLETE RF LABORATORY: HP-8407A 110MHz Network Analyzer w/8412A display, cost \$11,600 in 1983, mint \$795. HP-8601A Sweep Generator, cost \$4,000, now \$550. HP-1411 Spectrum Analyzer w/8553B, 8552B, \$2,095. HP-4815A Vector Impedance Meter, calibrated w/lab certificate, \$995. HP-8405A Vector Voltmeter, 1-1000MHz, w/certificate, \$650. HP-8551B Spectrum Analyzer, .01-12GHz, \$650. HP-5328A Communica-

tions Counter, 512MHz, ROM, sophisticated features, \$550. Tektronix 7904 complete 500MHz scope system, \$1,395. All working w/manuals. More lab equipment and much more low cost equipment on **GIANT SALE LIST**, LSASE please. Joseph Cohen, 200 Woodside, Winthrop MA 02152. (617) 846-6312. BNB563

RIG REPAIR by 20-year ham. Fast, reasonable. Skip Withrow, 5404 S. Walden Street, Aurora CO 80015. (303) 693-0997. BNB702

IBM PC VIDEO DIGITIZER 640 BY 480 RESOLUTION, 256 gray levels, \$89.98. Demo disk, \$3. Information, \$1. Colorburst, Box 3091, Nashua NH 03061. BNB703

ROSS' \$\$\$\$ NEW July (ONLY): KENWOOD TS-140S \$779.90, PB-2 \$36.00, R-5000 \$819.90, ICOM 735 \$848.00, 471H \$849.99, AG-35 \$59.99. O4AT \$269.99, YAESU FT-212RH \$317.90, FT-709R \$279.99, FT-470 \$388.00, ALLIANCE HD-73 \$152.90, U-105 \$51.90. ALL LIMITED TIME OFFER CALL OR SEND 2 STAMPS FOR MORE SPECIALS. LOOKING FOR SOMETHING NOT LISTED OR HARD TO FIND CALL OR WRITE. Over 9,000 ham-related items in stock for immediate shipment. Mention ad. Prices cash, F.O.B. Preston. HOURS TUESDAY-FRIDAY 9:00 TO 6:00, 9:00-2:00 P.M. MONDAYS. CLOSED SATURDAY & SUNDAY. ROSS DISTRIBUTING COMPANY, 78 SOUTH STATE, PRESTON ID 83263. (208) 852-0830. BNB707

SEIZED GOODS, radios, stereos, computers, and more by FBI, IRS, DEA. Available in your area now. Call (800) 338-3388 Ext. C-6223. BNB711

GIANT SOLAR PANELS \$44.00 EA! Excellent Prices/Solar Equipment/Accessories. Free Information/Send Stamped Envelope, Catalog \$3.00. To: Pak Rat Electronics, P.O. Box 690073, Houston TX 77269. (713) 893-0313. BNB715

SIMPLEX REPEATERS \$149.00! We manufacture them ourselves. Pak Rat Electronics. (713) 893-0313. BNB716

ELECTRON TUBES: All types and sizes. Transmitting, receiving, microwave... Large inventory—same day shipping. Daily Electronics, P.O. Box 5029, Compton CA 90224. (800) 346-6667 or (213) 774-1255. BNB719

WE HAVE IT! AEA, Astron, Butternut, Cal-

book, Comet, Diamond, Hustler, Kantronics, Larsen Antennas, MFJ, Radio Shack, Smiley, antennas, Ten-Tec, Valor antennas, and more. Small town service with discount prices. Dandys, 120 N. Washington, Wellington KS 67152. (316) 326-6314. BNB722

MINIATURE POLICE RADAR TRANSMITTER one mile range, \$41 assembled, \$31.00 kit, (219) 489-1711. P.O. Box 80096, Fort Wayne IN 46898. BNB725

BUILD YOUR OWN WIRE ANTENNAS, parts, GROUND RADIAL WIRE, open-wire feedlines, copper-weld, insulators, coax, Dacron rope, baluns, etc., LOWEST PRICES. Catalog, \$1.00, DAVIS RF Co., P.O. Box 230-S, Carlisle MA 01741. (800) 484-4002, code 1356. BNB726

HAM RADIO REPAIR Experienced, reliable service. Robert Hall Electronics, 1660 McKee Rd., Suite A, San Jose CA 95116. (408) 729-8200. BNB751

DIGITAL AUTOMATIC DISPLAYS. Kenwood, Yaesu, Collins, Drake, Atlas, etc. No bandswitching. Business, \$5.52 SASE. Specify radio. GRAND, P.O.B 3377, Blaine WA 98230. Phone/FAX: (604) 530-4551. BNB758

WANTED: HAM EQUIPMENT AND OTHER PROPERTY. The Radio Club of Junior High School 22 NYC, Inc., is a nonprofit organization, granted 501(C)(3) status by the IRS, incorporated with the goal of using the theme of Ham Radio to further and enhance the education of young people nationwide. Your property donation or financial support would be greatly appreciated and acknowledged with a receipt for your tax deductible contribution. Please look over whatever unwanted equipment you may have, and call us. We will pick up or arrange shipping. You will receive the tax deduction, but most important, the privilege of knowing that your gift really made a difference in the education and upbringing of a child. You are invited to check into the WB2JKJ "22 Crew" CLASSROOM NET, 7 AM EST on 7.238 MHz or on 21.395 throughout the day. Hope to meet all of our friends at the Huntsville Alabama Hamfest in August. We will be presenting a forum on EDUCOM. Write us at: The RC of JHS 22 NYC, INC., P.O. Box 1052, New York NY 10002. Round the clock HOTLINES: Voice (516) 674-4072, FAX (516) 674-9600. BNB762

ELIMINATE MULTIPLE NOISE TONES in your receiver audio output. The revolutionary new JPS noise filter, model #NF-60, Digital Signal Processing simple hook up. Unlike other Notch Filters, notches out multiple varying tones. **Deep Discounted**: \$139.50 delivered continental U.S. (Elsewhere \$150.00 plus shipping.) Authorized JPS dealer: Davis RF Co., P.O. Box 230-S, Carlisle MA 01741. 24-HR orders: (800) 484-4002, code 1356. BNB763

SOLAR POWERED HAMS! The Sunswitch is a charge controller to protect your batteries from over charge. Power MOSFETs are used, no relays! Assembled tuned and tested \$39.95 plus \$2.50 shipping. Sunlight Energy Systems, 2225 Mayflower NW, Massillon OH 44647. BNB774

NEON CALL SIGNS Your call letters illuminated in neon. Several custom styles and colors to choose from. For more info call. **LIGHTWRITERS NEON** (708) 441-9115 or write 911 Green Bay Road, Winnetka IL 60093-9022. BNB775

LAMBDA AMATEUR RADIO CLUB International amateur radio club for gay and

lesbian hams. On-air skeds, monthly newsletter, and annual gathering at Dayton. (215) 978-LARC. P.O. Box 24810, Philadelphia PA 19130. BNB812

73 MAGAZINE INDEX 1960-1990. Book \$15 or software \$20. The world's largest (60,000 reference) amateur radio index 1909-1990. Software \$85. QST, CQ, HR, or RADCAM indices \$10-\$20. Write: **DIDAH** Publishing, P.O.B. 7368, Nashua NH 03060-7368. (603) 878-3628. BNB813

FREE SHAREWARE AND HAM CATALOG for IBM or CoCo. Morse code computer interfaces, \$49.95. Dynamic Electronics, Box 896, Hartselle AL 35640. 205-773-2758. BNB815

DIGITAL SWR and POWER METER, Assemble, Kit, or Plans, with Alarm and Set Points. **FREE** information. **RUPP ELECTRONICS**, 5403 Westbreeze, Fort Wayne IN 46804. 291-432-3049. BNB831

TELEX HY-GAIN Antennas, Rotors and Replacement rotor parts, Cushcraft, Barker and Williamson, Periphex batteries, ARRL Books, Pyramid power supplies, GRE scanner amplifiers and converters, Surplus Tubes. Atkinson & Smith, 17 Lewis St. Eatontown NJ 07724. (800) 542-2247. BNB835

FCC COMMERCIAL LICENSE PREPARATION RADIOTELEPHONE-RADIOTELEGRAPH. Latest home study fast easy audio video. **FREE** details WPT Publications 1-800-800-7588. BNB840

PRINTED CIRCUIT BOARDS—etched, drilled, tin-plated. Single sided \$1.25/sq. inch. No setup charge. Send negative or artwork (\$10.00 for negative). We can generate artwork from your schematic. **CHELCO ELECTRONICS**, 61 Water St. Mayville NY 14757-1-800-388-8521. BNB842

INEXPENSIVE HAM RADIO EQUIPMENT. Send postage stamp for list. Jim Brady WA4DSO, 3037 Audrey Dr., Gastonia NC 28054. BNB890

MORSE CODE MUSIC? Yes it's true! Now the Morse code alphabet can be learned and enjoyed while doing aerobics, jogging, driving, or dancing. **ORDER "RHYTHM OF THE CODE"** cassette single hit today! Send \$5.95 (plus \$2 S&H) to "Kawa Productions," P.O. Box 319, Dept. ST, Weymouth MA 02188. For information send SASE. BNB899

AMATEUR RADIO REPAIR!! All makes & models, any age. \$20.00 per hour—maximum labor per unit, \$80.00. TELO (Dan), 1302 S. Uplands Dr., Camano Island WA 98292. (206) 387-3558. BNB900

COLLEGE \$\$\$\$ for ALMOST ANYONE! CALL for your **FREE** copy of "10 Ways To Stretch Your Scholarship Chances" 1-800-524-4916. (73 DE NX7T). BNB901

U.S. REPEATER MAPBOOK-A must for the mobile operator. Covers 28-1200 MHz, includes all 50 States, with maps. \$9.95 + \$2.50 s/h. **DOYLE COMMUNICATIONS-BB**, Route 8 Box 18, Lake Pleasant NY 12108. BNB902

HEATHKIT NOSTALGIA—Relive the history of the company which developed and manufactured the popular electronic kits. Pictures and stories of and by the people who were involved. 120+ pages. Send \$9.95 (WA residents add sales tax) to Heath Nostalgia, 4320-196th S.W., Suite B-111, Lynnwood WA 98036. BNB903

COMMUNICATIONS AT ITS BEST! AR-900/950 \$239.00, AR-1000XC \$399.00, AR-2500 \$469.00, AR-3000 \$969.00, Lowest

prices on AOR Radio guaranteed. CB's, Scanners, Radar detectors, and more. **Free Shipping Visa/MC/AMEX.** Turbo Electronics, P.O. Box 8034, Hicksville NY 11802. Inquiries: 516-938-1946/orders 1-800-33-TURBO. BNB905

USED EPROMS!!! CLEANED AND ERASED 27C128-1, \$2.75; 27C256-2, \$3.50; 27512-2, \$5.00; 27C010-2, \$9.00. Satisfaction guaranteed!!! Minimum \$5.00 order. Eproms, Dept. ST, PO Box 1931, Salem NH 03079 or call (603) 898-2908. BNB906

PILL BOTTLE ANTENNA TUNER! Really works!! Plans-\$3. DWM ENTERPRISES, 1709 N. West, #103, Jackson MI 49202. BNB907

XBEAM CALCULATIONS PROGRAM. SASE for information to M.L. COTE, 745 NYE CIRCLE, HONOLULU HI 96818. BNB908

EASYTERM, a user-friendly, full featured communications program for the AEA PK232MBX and Kenwood digital radios. For more information on this \$29.95 program, call 1-800-336-7796 or write to: EASYTERM, % M.V. Henley's Inc., P.O. Box 2154, Edgartown MA 02539-2154. BNB909

BATTERY PACK REBUILDING: SEND YOUR PACK / FAST SERVICE. ICOM: BP2/BP3/BP22 \$18.95, BP5/BP8/BP23 \$24.95. BP24/BP70 \$26.95, BP7 \$29.95. KENWOOD PB21 \$14.95, PB21H/PB6 \$19.95, PB25/26 \$22.95, PB2/KNB3 \$29.95.

YAESU: FNB10/17 \$22.95, FNB3/4/4A \$34.95. UNIDEN APX650 \$29.95, APX1200 \$39.95; HEATH110 \$26.95. "NEW PACKS": ICOM BP8(800 mA) \$39.95, (1000) \$49.95, (1200) \$54.95, BP83 \$29.95, BP84 \$42.95. YAESU: FNB2(500) \$19.95, (600) \$23.95, FNB10S (1000) \$42.95, FNB12S(600) \$46.95, FNB17(600) \$31.95, FNB4SL(750) \$44.95. SANTEC: 142/1200 \$22.95. "U-DO-IT INSERTS" ICOM: BP3/BP22 \$14.95, BP5 \$20.95, BP8 \$19.95. KENWOOD: PB21H/24 \$14.95, PB25/26 \$17.95. TEMPO/S \$20.95. YAESU: FNB10 \$14.95, FNB4/4A \$26.95. AZDEN/300 \$14.95. FREE CATALOG. \$4.00 Shipping/order, PA+6%, VISA-MC +\$3.00, CUNARD, R.D. 6 BOX 104, Bedford PA 15522. (814) 623-7000. BNB913

WANTED: BUY & SELL All types of Electron Tubes. Call toll free 1 (800) 421-9397 or 1 (612) 429-9397. C & N Electronics, Harold Bramstedt, 6104 Egg Lake Road, Hugo MN 55038. BNB915

COMMODORE 64 HAM PROGRAMS 8 disk sides over 200 Ham programs \$16.95/\$29 stamp gets unusual software catalog of Utilities, Games, Adult and British Disks. Home-Spun Software, Box 1064-BB, Estero FL 33928. BNB917

WAYNE'S WRONG! CoCo lives! Wanted: Tandy color computer junk! One person's trash-80 is another's treasure! KA1UVE Chas. Scanlon, 2 Eagle Ln., Simsbury CT 06070-1703, (203) 657-8373. BNB961

GOVERNMENT SUPPLUS- Great deals on

electronics, computers, cars, boats, office equipment etc. For a listing of addresses and telephone numbers of Federal and State Agencies send \$3 to Dave Gauthier, 20 Bennett Street, North Providence RI 02904. BNB962

WANTED-Drake-R4C-Digital with Sherwood Mods and C.W. Filters or a good C.W. Rcvr. Bill WA2VLE, (516) 281-6498 Eves, E.S.T. BNB963

FOR SALE: Alpha 86 \$2,200, Hammerlund HXL1 \$300, TS440S \$900, Uniden 7000 \$150, VCII \$100, HIL, N5AX. (619) 253-7710. BNB964

WANTED: Facsimile transceiver AN/TXC-1 or similar lg. drum type FAX machine. Ecola, P.O.B. 3284, San Bernardino CA 92413. BNB965

PRINTED CIRCUIT BOARDS for projects in 73, *Ham Radio*, *QST*, *ARRL Handbook*. List SASE. FAR Circuits, 18N640 Field Ct., Dundee IL 60118. BNB966

AZDEN SERVICE by former factory technician. Southern Technologies Amateur Radio, Inc., 10715 SW 190 St. #9, Miami FL 33157. (305) 238-3327. BNB979

COMMODORE 64 REPAIR Fast turn around. Southern Technologies Amateur Radio, 10715 SW 190th Street #9, Miami FL 33157. (305) 238-3327. BNB982

FOR SALE: Seven 450 MHz BP/BR filters, \$350, K. Spies, P.O.B. 48185, Niles, IL 60064-0185. BNB983

THE AMAZING UNIVERSAL CABLE TV AND SATELLITE DESCRAMBLER. De-

tailed plans, theory, parts list, instructions, and troubleshooters newsletter. 20 pages. \$13.95 postpaid. OCTE-D, Box 276, Alburg VT 05440. BNB985

MIAMI SCANNER ACTION IS HOT. Hear the cops and more. One call does it all. (305) 460-3374. BNB986

HOBBY/BROADCASTING/HAM/CD/SURV EILLANCE transmitters, amplifiers, cable TV, science, bugs, other great projects! For catalog, call/write (916) 534-0417. PANAXIS, Box 130-S9, Paradise CA 95967. BNB991

AMATEUR RADIO REPAIR: FCC licensed, 17 years experience, lab quality NBS traceable test equipment, reasonable rates, G.B. Communications, Inc., 963 Birch Bay, Lynden Road, Lynden WA 98264. (206) 354-5884. BNB993

VIDEOCIPHER/SATELLITE/SCANNER/CABLE/AMATEUR/CELLULAR. Repair Manuals, Modification Books & Software. Catalog-\$3.00. TELECODE P.O. Box 6426-RF, Yuma AZ 85366-6426. BNB994

ROTOR PARTS ROTOR service, ROTOR accessories: Brak-D-Lays, Quik-Connects, Pre-Set models. NEW models for sale. Free catalog. C.A.T.S., 7368 SR 105, Pemberville OH 43450. BNB996

SURPLUS. HUGE QUANTITIES. LOWEST PRICES in America! Dealers wanted. Catalogs, \$3. Surplus Traders, Box 276A, Alburg VT 05440. BNB997

FOR SALE: Clegg Mark 3 2m FM, working but NMR \$75, Klaus Spies POB 48185, Niles IL 60648-0185. BNB998

Number 27 on your Feedback card

DEALER DIRECTORY

DELAWARE

New Castle

Factory authorized dealer! Yaesu, ICOM, Kenwood, Ten-Tec, AEA, Kantronics, DRSI Mfg., Ameritron, Cushcraft, HyGain, Heil Sound, Standard Amateur Radio, MFJ, Hustler, Diamond, Butternut, Astron, Larsen, and much more. **DELAWARE AMATEUR SUPPLY, 71 Meadow Road, New Castle DE 19720. (302) 328-7728.**

NEW JERSEY

Park Ridge

North Jersey's oldest and finest Shortwave and Ham Radio Dealer. 1 1/2 miles from Garden State Parkway. Authorized Dealers for AEA, Kenwood, Japan Radio Company, ICOM, Yaesu, etc. Ham Sales, Lee WK2T. **GILFER SHORTWAVE, 52 Park Ave., Park Ridge NJ 07656. (201) 391-7887.**

NEW YORK

Manhattan

Manhattan's largest and only ham and business Radio Store. Featuring MOTOROLA, ICOM, KENWOOD, YAESU, UNIDEN BENDIX-KING, ASTRON, AEA, SONY, PANASONIC, MFJ, CCTV CAMERAS AND MONITORS, BIRD WATTMETERS, OPTOELECTRONICS FREQUENCY COUNTERS, AOR SCANNERS, JRC Receivers, Kantronics, Larsen, etc. Full stock of radios and

accessories. Repair lab on premises. Open 7 days M-F, 9-6 p.m.; Sat. & Sun., 10-5 p.m. We ship Worldwide. For specific information call or write: **BARRY ELECTRONICS, 512 Broadway, New York NY 10012. (212) 925-7000. FAX (212) 925-7001.**

OHIO

Columbus

Central Ohio's full-line authorized dealer for Kenwood, ICOM, Yaesu, Alinco, Japan Radio, Standard, AEA, Cushcraft, Hustler, Diamond and MFJ. New and used equipment on display and operational in our new 10,000 sq. ft. facility. Large SWL Department, too. **UNIVERSAL RADIO, 6830 Americana Pkwy., Reynoldsburg (Columbus) OH 43068. (614) 866-4267.**

PENNSYLVANIA

Trevese

Authorized factory sales and service. KENWOOD, ICOM, YAESU, featuring AMERITRON, B&W, MFJ, HYGAIN, KLM, CUSHCRAFT, HUSTLER, KANTRONICS, AEA, VIBROPLEX, HEIL, CALLBOOK, ARRL Publications, and much more. **HAMTRONICS, INC., 4033 Brownsville Road, Trevese PA 19047. (215) 357-1400. FAX (215) 355-8958. Sales Order 1-800-426-2820. Circle Reader Service 298 for more information.**

DEALERS: Your company name and message can contain up to 50 words for as little as \$420 yearly (prepaid), or \$210 for six months (prepaid). No mention of mail-order business please. Directory text and payment must reach us 60 days in advance of publication. For example, advertising for the April '92 issue must be in our hands by February 1st. Mail to 73 Amateur Radio Today, 70 Rte. 202 N, Peterborough, NH 03458.

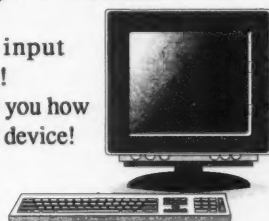
Eavesdrop on PC's!

How can you see what's on someone's screen from up to a half mile away?

Our Van Eck Device will allow you to **INTERCEPT SIGNALS FROM A PC'S MONITOR** and display it in real time.

Watch as people input information!

The manual will show you how to **EASILY** build the device!



Also in the Manual: Complete Schematics and Detailed Parts List

CALL FOR PRICING ON COMPLETELY ASSEMBLED MODELS

Complete Manual only \$79.95

M.O. or C.O.D. to SPY Supply

7 Colby Court Suite 215, Bedford, NH 03110

(617) 327-7272

Sold for educational purposes only

Uncle Wayne's BookShelf

REFERENCE

20N101 Everyday Electronics Data Book by Mike Tooley BA. Information is presented in the form of a basic electronic recipe book with numerous examples showing how theory can be put into practice using a range of commonly available 'industry standard' components and devices. 256 pp. 134 line drawings. \$18.00

20N102 Practical Digital Electronics Handbook by Mike Tooley contains nine digital test gear projects, CMOS, and TTL pinouts and tables or reference data. Introduces digital circuits, logic gates, bistables and timers, microprocessors, memory and input/output devices, before looking at the RS-232C interface and the IEEE-488 and IEEE-1000 microprocessors buses. 208 pp., 100 line drawings. \$14.50

20N103 Electronic Power Supply Handbook by Ian R. Sinclair covers many types of supplies—batteries, simple AC supplies, switch mode supplies and inverters. All types of supplies used for electronics purposes are covered in detail, starting with cells and batteries and extending by way of rectified supplies and linear stabilizers to modern switch-mode systems, IC switch-mode regulators, DC-DC converters and inverters. 144 pp., 90 line drawings. \$16.25

20N104 Electronic Test Equipment Handbook by Steve Money is a guide to electronic test equipment for the engineer, technician, student and home enthusiast. Provides a practical guide to widely used electronics instruments and the techniques of measuring a wide range of parameters in electronics systems. 216 pp., 123 line drawings. \$18.00

20N105 Digital Logic Gates and Flip-flops by Ian R. Sinclair, what they do and how to use them. Seeks to establish a firm foundation in digital electronics by treating the topics of gates and flip-flops thoroughly and from the beginning. For the user who wants to design and troubleshoot digital circuitry with considerably more understanding of principles than the constructor, and who wants to know more than a few rules of thumb about digital circuits. 204 pp., 168 line drawings. \$18.00

02C30 The Commodore Ham's Companion by Jim Grubbs K9EI 160 pages of useful information on selecting a Commodore computer for the ham shack, where to find specialized programs, the Commodore-packet connection, and more! \$9.50

09D22 The World Ham Net Directory by Mike Wikowski New—second edition now over 600 net listings. This book introduces the special interest ham radio networks and shows you when and where you can tune them in. \$9.50



10F091 1992 International Callbook The new 1992 International Callbook lists 500,000 licensed radio amateurs in the countries outside North America. It covers South America, Europe, Africa, Asia, and the Pacific area (exclusive of Hawaii and the U.S. possessions). \$29.95

10D091 1992 North American Callbook The 1992 North American Callbook lists the calls, names, and address information for over 500,000 licensed radio amateurs in all countries of North America, from Panama to Canada including Greenland, Bermuda, and the Caribbean islands plus Hawaii and U.S. possessions. \$29.95

05H24 Radio Handbook, 23rd Ed. by William I. Orr W6SAJ 840 pages of everything you wanted to know about radio communication. In-depth study of AC/DC fundamentals, SSB, antennas, amplifiers, power supplies, and more. \$29.50 hard cover only

12E76 Basic Electronics Prepared by the Bureau of Naval Personnel

Thoroughly revised in 1972. Covers the important aspects of applied electronics and electronics communications. 567 pp. \$10.95

12E41 Second Level Basic Electronics Prepared by the Bureau of Naval Personnel Sequel to *Basic Electronics*, thorough treatment of the more advanced levels of applied electronics. Includes microwave receiving and transmitting. Hundreds of excellent diagrams. 325 pp. \$7.50

01D45 The Illustrated Dictionary of Electronics, 5th Ed. by Rufus P. Turner and Stan Gibilisco Featuring more than 27,000 entries, an exhaustive list of abbreviations, and appendices packed with schematic symbols and conversion tables, this is by far the most comprehensive dictionary of practical electronics and computer terms available. 720 pages \$26.95

04M54 GGT Morse Tutor From beginner to Extra class in easy self-paced lessons. Code speeds from 1 to over 100 words per minute. Standard or Farnsworth mode. Adjustable tone frequency. Create your own drills, practice or actual exams. Exams conform to FCC requirements. 5 1/4 floppy for IBM PC, XT, AT, PS/2 or compatibles \$19.50

04M55 Advanced Edition \$29.95

20N091 Most-Often-Needed Radio Diagrams and Servicing Information, 1926-1938, Volume One compiled by M.N. Beiman An invaluable reference for anyone involved in Vintage Radio restoration. Hundreds of schematics, wiring diagrams and parts lists. All from the original sources. \$11.95

20N096 How To Read Schematics (4th edition) by Donald E. Herrington Written for the beginner in electronics, but it also contains information valuable to the hobbyist and engineering technician. This book is your key to unlocking the mysteries of schematics, beginning with a general discussion of electronic diagrams. \$14.95

20N097 Radio Operator's World Atlas by Walt Stinson, WCP This is a compact (5x7), detailed, and comprehensive world atlas designed as a constant desk top companion for radio operators, and as a replacement for the traditional bulky and outdated atlases. Also included are 42 pages of vital statistics about each country. Popular with DXers worldwide. \$17.95

20N020 Secrets of RF Circuit Design by Joseph J. Carr Written in clear non-technical language, covers everything from antennas to transistors. You will learn the basics of receiver operation, the proper use and repair of components in RF circuits, the principles of radio signal propagation from low frequencies to microwave, and much more! \$19.50

SHORTWAVE

06S57 1992 Passport to World Band Radio by International Broadcasting Services, Ltd. You can have the world at your fingertips. You'll get the latest station and time grids, the 1992 Buyer's Guide and more. 384 pages. \$16.50

03S11 Shortwave Receivers Past and Present edited by Fred J. Osterman Concise guide to 200+ shortwave receivers manufactured in the last 20 years. Gives key information on each model including coverage, display, circuit type, performance, new value, used value, etc. Photos on most models. The Blue Book of shortwave radio value. 1987, 104 pages, 8 1/2 x 11. \$8.95

07R25 The RTTY Listener by Fred Osterman New and expanded version. This specialized book compiles issues 1 through 25 of the *RTTY Listener Newsletter*. It contains up-to-date, hard-to-find information on advanced RTTY and FAX monitoring techniques and frequencies. 224 pages. \$19.95

03C09 Shortwave Clandestine Confidential by Gerry L. Dexter Covers all clandestine broadcasting, country by country: tells frequencies, other unpublished information: spy, insurgents, freedom fighters, rebel, anarchist radio, secret radio. Current publication. 84 pages. \$8.50

03M221 US Military Communications (Part 1) Deals with US Military communication channels on shortwave. Covers frequencies, background on point to point frequencies for the Philippines, Japan and Korea, Indian and Pacific Oceans, and more. 102 pages. \$12.95

03M222 US Military Communications (Part 2) Covers US Coastguard, NASA, CAP, FAA, Dept. of Energy, Federal Emergency Management Agency, Disaster Communications, FCC, Dept. of Justice. From 14 KC to 9073 KC. 79 pages. \$12.95

03M223 US Military Communications (Part 3) This part completes the vast overall frequency list of US Military services, from 8993 KC to 27,944 KC. 78 pages. \$12.95

09S42 The Scanner Listener's Handbook by Edward Soome NZ8FF Get the most out of your scanner radio. Covers getting started, scanners and receivers, antennas, coaxial cable, accessories, computer controlled monitoring, more. \$14.95

03S208 Radio Teletype Press Broadcasts by Michael Schey Covers schedules of Press Services by time, frequency, and country broadcasting in English, French, German, Spanish, and Portuguese. Detailed Press Agency Portraits. 120 pp. \$12.95

11T88 Tune in on Telephone Calls by Tom Kneitel K2AES Formatted as a frequency list with detailed description of each service and its location in RF spectrum. Provides basic information for casual listeners getting started and details for ardent enthusiasts. \$12.95

03K205 Guide to Radioteletype (RTTY) Stations by J. Klingenstein Updated book covers all RTTY stations from 3MHz-30MHz. Press, Military, Commercial, Metro, PTTs, embassies, and more. 105 pp. \$12.95

11AS10 Air Scan Guide to Aeronautical Communications (5th Edition) by Tom Kneitel K2AES Most comprehensive guide to monitoring aeronautical communication in the US. Expanded to cover all Canadian land airports and seaplane bases, plus listings for Central America, the Caribbean, North Atlantic, and the Pacific Territories. \$14.95

07A66 Aeronautical Communications Handbook by Robert E. Evans Exhaustive, scholarly treatment of shortwave aeronautical listening. Well organized, up-to-date. 266 pp. \$19.95

07R20 A Radio Journal 1912-1940 by Russ Renaker W9CRC A fascinating trip through time. Easy to read and informative, educational and entertaining. A trip down memory lane to the early days of radio. \$9.95

11RF13 The "Top Secret" Registry of US Government Radio Frequencies (7th Ed.) by Tom Kneitel K2AES This scanner directory has become the standard reference source for frequency and other important information relating to the communications of federal agencies. 25 to 470 MHz. \$19.95

11F52 Ferrell's Confidential Frequency List compiled by A.G. Halligan All frequencies from 4MHz-28MHz covering ship, embassy, aero, Volmet, Interpol, numbers, Air Force One/Two, more 376 pp. \$19.50

11S97 National Directory of Survival Radio Frequencies by Tom Kneitel K2AES Handy and concise reference guide to high interest communications frequencies required by survivalists. Includes chapter on building emergency communications antenna systems. \$8.95

11SM11 Scanner Modification Handbook, Vol. 1 by Bill Creek Provides straightforward step-by-step instructions for expanding the operating capabilities of VHF scanners. Filled with interesting text, helpful photos, tables, and figures. \$17.95

11EE06 Guide to Embassy Espionage Communications by Tom Kneitel K2AES Candid and probing examination of worldwide embassy and (alleged) espionage communication systems and networks. Extensive nation-by-nation directory of embassy stations is included. \$10.95

15D91 1992 Shortwave Directory (7th ed.) by Bob Grove Extensively revised, the new 1992 Shortwave Directory is the consummate DXer's bible for the first 30 MHz of radio spectrum, including up-to-date and accurate VLF information as well. 270 information-packed and illustrated pages in convenient 8 1/2 x 11 format professionally bound. \$21.95

20N093 Vintage Radio 1887-1929 by Morgan E. McMahon Recaptures the excitement of the early days. The authoritative reference book for historians and collectors. \$8.95

20N094 A Flick of the Switch, 1930-1950 by Morgan E. McMahon Here's your chance to recapture the thrill of old-time radio and television. Browse through a thousand photos and fascinating old ads. Discover the fast-growing hobby of radio collecting, and perhaps find a treasure in your own attic or cellar. \$8.95

20N095 World Broadcast Station Address Book by Gerry L. Dexter A must for the serious shortwave listener. Hundreds of addresses for shortwave broadcast stations. Special sections with helpful information to increase your QSL percentage. \$8.95

07R26 World Wide Aeronautical Communications by Robert E. Evans This 42 page book was designed to update and augment the frequency lists published in the *Aeronautical Communications Handbook-HF Edition*. Contents include Aircraft/Air Traffic Control, Aircraft/Company Operations, Aviation Weather Broadcasts, Aeronautical Flight Tests, Worldwide Military Air Forces, Aero Search & Rescue, Aero Law Enforcement, NASA Flight Support, Aero Terms & Abbreviations and Aero Tactical Identifiers. \$6.95

11T89 Scanner Modification Handbook Vol. 2 by Bill Creek Here it is—a companion to Vol. 1. In fact, Vol. 2 has a section that provides improved approaches and updated techniques for the mods in Vol. 1. There's 18 new, exciting modifications for popular scanners and is fully illustrated with photos and schematics, highly detailed. \$17.95

UHF/VHF/PACKET

09V11 The Basic Guide to VHF/UHF Ham Radio by Edward M. Noll This book provides a first rate introduction to life on the 2.6 and 1.25 meter bands as well as 23, 33, and 70cm. \$6.50

01P22 The Packet Radio Handbook by Jonathan L. Madsen KR3T "...an excellent piece of work. Well worth reading for both the experienced and the new packeteer..."—the definitive guide to amateur packet operation. —Gwyn Reedy WIBEL Only \$15.00

tailed step-by-step instructions so that the average hobbyist can do these performance enhancing modifications. This is an all new book that has all new mods. \$17.95

03R01 World Press Services Frequencies (RTTY) Vol. 5th edition. A comprehensive manual covering radioteletype news monitoring—contains all information—antenna, receiving, terminal units, plus three extensive frequency lists. Covers 65 World Press Services broadcasting in English. "The Original Press Book." 84 pp. \$8.95

VIS Study Cards Advance the easy way with VIS Study Cards. Compact, Up-to-date Flash Cards with Key Words, Underlined, Quiz on Back. Formulas worked out. Schematics at your fingertips. Used SUCCESSFULLY by ages 6 to 81!

NOVICE	VIS01	\$11.95
TECH	VIS02	18.95
GENERAL	VIS03	9.95
ADVANCED	VIS04	15.95
EXTRA	VIS05	14.95

Lanze Code Programs—(Available on 5 1/4" disk.) Inexpensive complete study guide code programs for both the C64/128 Commodores and the IBM compatibles. Programs include updated FCC questions, multiple choice answers, formulas, schematic symbols, diagrams, and simulated (VE) sample test.

IBM Part#	Commodore Part#	Price	
Novice	IBM01	COM01	\$14.95
Tech	IBM02	COM02	\$14.95
General	IBM03	COM03	\$14.95
Advance	IBM04	COM04	\$19.95
Extra (New Pool)	IBM05	COM05	\$19.95

IBM06, COM06 IBM/Commodore Tech No Code—Lanze Code Program contains all the authorized FCC questions and answers used in testing formulas, schematic symbols, diagrams, and sample test for passing the new Technician No Code license. \$24.95

IBM97 Amateur Radio Part 97 Rules (includes updated, revised Commission's Rules, September 30, 1989) 5 1/4" disk IBM compatible only. \$9.95

ANTENNAS

05A95 • Easy-up Antennas for Radio Listeners and Hams by Edward M. Noll Like to learn how to construct low-cost, easy-to-erect antennas? *Easy-up Antennas* will help you. \$16.50

01A70 • Practical Antenna Handbook by Joseph J. Carr Design, build, modify, and install your own antennas. Carr, a 20-year veteran of technical writing, has a unique ability to present complex technical concepts in an easy-to-understand way. 416 pp. \$21.50

20N019 U.S. Repeater Mapbook by William Smith, N6MQS The Guide for traveling radio amateurs gives you repeater frequencies, and locations on easy to read state map. Includes all 50 states, and 28-1200 MHz. \$9.95

03R02 RTTY Today by Dave Ingram K4TWJ Only up-to-date RTTY book in existence. Covers all facets of RTTY. Most comprehensive RTTY guide ever published. Fully illustrated. 112 pages. \$8.50

ARRL BOOKS

AR1991 ARRL 1992 Handbook (68th ed.) 39 chapters, featuring 2,100 tables, figures and charts. The most comprehensive, well organized and affordable source of amateur radio reference material. 1232 pages. \$25.00

AR1086 ARRL Operating Manual Packed with information on how to make the best use of your station, including: interfacing home computers, OSCAR, VHF-UHF, contesting. \$17.00

AR0194 Antenna Compendium Vol. 1 Materials on verticals, quads, loops, yagis, reduced size antennas, baluns, Smith Charts, antenna polarization, and other interesting subjects. \$10.00

AR2545 Antenna Compendium Vol. 2 42 papers covering verticals, yagis, quads, multiband and broadband systems, antenna selection, and much more. \$12.00

AR2626 Companion Software for Antenna Compendium Vol. 2 514" MS-DOS floppy. \$10.00

AR0488 W1FB's Antenna Notebook by Doug DeMaw W1FB Get the best performance out of unobtrusive wire antennas and verticals. Build tuners and SWR bridges. \$8.00

AR0348 QRP Notebook by Doug DeMaw W1FB Presents construction projects for the QRP operator, from a simple 1 watt crystal-controlled transmitter to more complex transceiver designs. \$9.50

AR4141 W1FB's Design Notebook by Doug DeMaw W1FB This plain language book is filled with simple practical projects that can be built using readily-available components and common hand tools. \$10.00

AR2200 Antenna Impedance Matching by Wilfred N. Caron Most comprehensive book written on using Smith Charts in solving impedance matching problems. \$15.00

AR0402 Solid State Design Chock full of good, basic information, circuit designs and applications: descriptions of receivers, transmitters, power supplies, and test equipment. \$12.00

AR3290 Companion Software for Weather Satellite Handbook 514" MS-DOS Floppy. \$10.00

AR3193 Weather Satellite Handbook (4th ed.) by Dr. Ralph Taggart WB8DQT Hot off the press! Expanded and revised to reflect today's weather-fax satellite technology. \$20.00

AR3291 Now You're Talking! Discover the World of Ham Radio Successor to the immensely popular *Time in the World with Ham Radio*. Covers everything you need to know to earn your first Amateur Radio license. More than a study guide, this book will help you select equipment for your ham radio station and explain how to set it up—everything you'll need to know to get on the air! An ARRL Publication. \$19.00

AR3292 Your Introduction to Morse Code: Practice Cassettes Companion code course to *Now You're Talking!*, this kit includes two 90 minute cassette tapes. Prepares you for the 5 WPM Morse code exam to earn your Novice license or add high-frequency worldwide communications privileges to your code-free Technician license. \$10.00

AR0437 ARRL Repeater Directory 1992-1993 Over 19,000 listings with digipeaters, handplans, CTCSS (PL*) tone chart, compilation of frequency coordinators, ARRL special service clubs, and beacon listings from 14MHz to 24GHz. \$6.00

AR1033 The DXCC Companion by Jim Kearman KR1S spells out in simple, straightforward terms what you need to be a successful DX'er. \$6.00

AR1250 Log Book—Spiral \$3.50
AR4341 Interference Handbook Written from an RFI sleuth's perspective. His experience in solving interference problems. \$12.00

AR2197 Data Book Valuable aid to the RF design engineer, technician, radio amateur, and experimenter. Commonly used tables, charts, and those hard-to-remember formulas. \$12.00

AR2960 Transmission Line Transformers (2nd ed.) by Dr. Jerry Sevick W2FMI Practical designs and specification information on construction techniques and sources of material. More designs for antenna tuners, hybrids, and for the VHF and UHF bands. 272 pp. \$20.00

AR0410 Yagi Antenna Design Originally published as a series in *Ham Radio*, polished and expanded by Dr. Lawson. \$15.00

AR2171 Hints and Kinks Find the answer to that tricky problem. Ideas for setting up your gear for comfortable, efficient operation. \$8.00

AR3169 QRP Classics Collection of articles from last 15 years of ARRL publications on building receivers, transmitters, transceiver, accessories, 288 pp. \$12.00

wire antennas along with a lot of his antenna secrets and "how-to-do" helps. \$9.50

20N021 No Code Ham Radio Education Package Computer software package. Clear, concise, and easy to understand. This package includes computer aided instruction software (IBM compatible), 200 page Ham Radio Handbook, and complete FCC Part 97 Amateur Radio rules and regulations. No prior knowledge of electronics is needed. \$28.95

20N022 Ham Operator Education Package Computer software contains five IBM compatible discs with all questions for all license classes, plus "Morse Academy" code teaching software that takes you from 0-20 wpm. Effortless and uncomplicated, everything is done from easy to understand menus. Review all questions, print out sample tests or take exams administered right at the computer keyboard. \$28.95

ful circuits, oscillators, multivibrators, bistables, and logic circuits. 128 pp., 18 photos, 72 line drawings. \$12.50

20N099 Digital Electronics Projects for Beginners by Owen Bishop contains 12 digital electronics projects suitable for the beginner to build with the minimum of equipment. 128 pp., 56 line drawings. \$12.50

AR2073 Novice Antenna Notebook A beginners guide to easy and effective antennas and tuners you can build. \$8.00 An ARRL Publication.

AR2871 W1FB's Help for New Hams by Doug DeMaw W1FB Complete for the newcomer. Put together a station and get on the air. \$10.00 An ARRL Publication.

AR2826 First Steps in Radio by Doug DeMaw W1FB Series of QST articles. See components assembled into practical circuits and how the circuits make up your radio gear. \$5.00 An ARRL Publication.

ARRL License Manuals All the theory you need to pass your test. Complete FCC question pools with answers.

AR2375 Technician Class \$6.00
AR2383 General Class \$6.00
AR0166 Advanced Class \$6.00
AR2391 Extra Class \$8.00

AR3185 The Satellite Experimenter's Handbook (2nd Ed.) by Martin Davidoff K2UBC Expanded and revised, this 2nd edition of "The Satellite Experimenter's Handbook" is your guide to using and designing satellites, focusing on those built by and for the international radio amateur community. \$20.00

AR0477 Low Band DXing How to meet the challenges of the different forms of 160, 80, and 40 meter propagation with effective antennas, equipment, and operating strategies. \$10.00

AR2456 FCC Rule Book (8th ed.) A must for every active radio amateur. \$9.00

AR2030 Your Gateway to Packet Radio (2nd ed.) Tells everything you need to know about this popular new mode: how to get started, equipment you need, and more. \$12.00

CODE TAPES

One answer to the no-code broa-ha-ha is to make the code so simple to learn that it's a non-problem. Herewith the world's easiest code course—tens of thousands of hams have gotten their licenses this amazing new shortcut way. It's failure-proof. Most people are able to whip through the Novice test after spending less than three hours each on *Genesis* and *The Stickler*. Most people have given up on other code courses find this one does the job in a jiffy. Going after your General? It's about time. Use the Back Breaker and you'll be there before you know it. A week should do it. Warning, 20wpm code almost invariably appears to cause irreparable, irreversible, permanent brain damage. Uncle Wayne cautions no responsibility whatever for anything that happens to those who are foolish enough to use the Courageous 20wpm tape.

73T05 "Genesis" \$5.95
5 wpm—This is the beginning tape, taking you through the 26 letters, 10 numbers, and necessary punctuation, complete with practice every step of the way. The ease of learning gives confidence even to the faint of heart.

73T13 "Back Breaker" \$5.95
13+ wpm—Code groups again, at a brisk 13+ wpm so you'll be really at ease when you sit down in front of a steady-eyed volunteer examiner who starts sending you plain language code at only 13 per. You'll need this extra margin to overcome the sheer panic universal in most test situations. You've come this far, so don't get code shy now!

AR2103 Satellite Anthology The latest information on OSCARs 9 through 13 as well as the RS satellites. Information on the use of digital modes, tracking antennas, RUDAK, microcomputer, and more! \$5.00

AR2898 Space Almanac by Anthony R. Curtis K3XXK Captures the breathtaking recent news from space. Includes information on Amateur Radio satellites. Find almost everything about man's trip to the stars. 960 pp. \$20.00

AR2083 Complete DX'er (2nd ed.) by Bob Locker W9KXJ Learn how to hunt DX and obtain hard-to-get QSL cards. \$12.00

AR2065 ARRL Antenna Book The new 16th edition represents the best and most highly regarded information on antenna fundamentals, transmission lines, design, and construction of wire antennas. Over 700 pages, over 900 figures. An ARRL Publication. \$20.00

AR3293 Morse Code: The Essential Language by L. Peter Carron Jr. W3DKV has been expanded and revised in its 2nd edition. Peter Carron details its fascinating history as well as sharing practical learning information. Readers will learn how to handle distress calls heard not only on the hambands but on maritime and aircraft frequencies. Copyright 1991, softcover. An ARRL Publication. \$6.00

73T06 "The Stickler" \$5.95
6+ wpm—This is the practice tape for those who survived the 5 wpm tape, and it's also the tape for the Novice and Technician licenses. It is comprised of one solid hour of code. Characters are sent at 13 wpm and speeded at 5 wpm. Code groups are entirely random characters sent in groups of five—definitely not memorizable!

73T20 "Courageous" \$5.95
20+ wpm—Congratulations! Okay, the challenge of code is what's gotten you this far, so don't quit now. Go for the extra class license. We send the code faster than 20 per. It's like wearing lead weights on your feet when you run: You'll wonder why the examiner is sending so slowly!

NEW STUFF

20N109 73 Magazine Index 1960-1990 A complete index to every article published in 73 Magazine through 1990. Eleven major categories, further subdivided into 25 individual subject areas, provides easy access to thousands of articles, and a wealth of technical information. Book \$15.00 IBM software (specify type) \$20.00

20N110 Product Reviews since 1945 contains an index to 3,400 product reviews that have appeared in QST, CQ, HR, 73, and Radcom. Alphabetically listed by manufacturer. Book \$12.95

20N108 The Easy Wire Antenna Handbook by Dave Ingram K4TWJ Get out your roll of wire and your wire cutters, you are ready to go with this new practical and easy to understand book. Gives you all of the needed dimensions for a full range of easy to build and erect "sky wires." Covers all of the many types of

BOOKS FOR BEGINNERS

20N018 Technician Class License Manual: New Book by Gordon West This book will cover everything you need to become a Technician Class Ham. Every exact question and answer on the examinations is found in this one book covering element 2 and element 3A question pools. Gordon West tells you the right answer and then explains in detail why the answer is correct. Fully illustrated text, frequency chart showing privileges, list of examiners and an FCC Form 610 application. \$9.95

20N092 The Wonderful World of Ham Radio by Richard Skolnik, KB4LCS This book addresses the plea that something simple, clear, and fun be written to introduce young people to amateur radio. Pick-up one for the new ham in your life. \$7.95

20N100 Electronics Build and Learn (2nd edition) by RA Penfold combines theory and practice so that you can "learn by doing." Full construction details of a circuit demonstrator unit that is used in subsequent chapters to introduce common electronic components. Describes how these components are built up into use-

ful circuits, oscillators, multivibrators, bistables, and logic circuits. 128 pp., 18 photos, 72 line drawings. \$12.50

20N099 Digital Electronics Projects for Beginners by Owen Bishop contains 12 digital electronics projects suitable for the beginner to build with the minimum of equipment. 128 pp., 56 line drawings. \$12.50

AR2073 Novice Antenna Notebook A beginners guide to easy and effective antennas and tuners you can build. \$8.00 An ARRL Publication.

AR2871 W1FB's Help for New Hams by Doug DeMaw W1FB Complete for the newcomer. Put together a station and get on the air. \$10.00 An ARRL Publication.

AR2826 First Steps in Radio by Doug DeMaw W1FB Series of QST articles. See components assembled into practical circuits and how the circuits make up your radio gear. \$5.00 An ARRL Publication.

Uncle Wayne's Bookshelf Order Form

You may order by mail, telephone, or fax. All payments are to be in US funds. Allow 3 weeks for delivery.

Item #	Title	Qty.	Price	Total

SHIPPING
TOTAL

SHIPPING

U.S. add \$3.00 mail, \$4.00 UPS.

Canada add \$4.00 mail.

U.P.S. to Canada and all foreign orders FOB Peterborough, NH.

Make checks payable to "Uncle Wayne's Bookshelf"

Name

Street

City

State

Zip

TOTAL \$

☐ AE

☐ MC

☐ VISA

☐ Check/Money Order

Card #

Expiration Date

Telephone: (603) 924-4196 (800) 234-8458 FAX: (603) 924-8613

Mail: Uncle Wayne's Bookshelf, 70 Route 202N, Peterborough, NH 03458

UW0792

RANDOM OUTPUT

David Cassidy N1GPH

If It Ain't Broke...

The ARRL and Fred Maia W5YI have, for reasons we will try to fathom, decided to fix something that isn't broken—Novice licensing. This is business as usual for the ARRL in their goal of total dictatorship over American amateur radio, but I haven't a clue what deal W5YI was promised in order to garner his support for this absolutely unnecessary and regressive proposal.

Tens of thousands of hams, including yours truly, were introduced to amateur radio through the current form of Novice testing. In my case, it was a high school amateur radio club. I attended after-school license classes for a couple of weeks, and when the club advisor thought we were ready, he and another ham-teacher administered the Novice exam to us. No trips to the FCC office in Boston (this was pre-VEC days), no unfamiliar surroundings or strange and different sounding Morse code test. My "elmer" guided me through the learning process, and he had the reward of seeing his efforts result in many proud young Novices.

The ARRL and W5YI would like to change all that. They have proposed to the FCC that all Novice testing be incorporated under the VEC program, and we must let the FCC know in no uncertain terms that the amateur radio population sees this for what it is: another blatant and self-serving power grab.

The ARRL and W5YI offer that their proposal would cut down on incorrect Novice license applications, thereby saving the FCC the time and expense of processing these forms. Boy... doesn't that sound peachy? All they want to do is help out the FCC, thereby saving time and money. How could anyone disagree with that?

Who said there was an unusually large amount of time and money being spent to deal with faulty Novice exams? Where is the research to back up the claim that this is a problem? If there is a problem, why hasn't the FCC ever mentioned it?

For sure, a certain number of Novice exams are bound to be submitted with examiner errors. Does the number of examiner errors justify eliminating a program that has been instrumental in gently introducing two generations of young people (not to mention the thousands of older hams) to amateur radio? The Novice test and license application is not quantum physics. It doesn't take a rocket scientist to correctly administer and submit a Novice exam. Could clearer instructions take care of the problem (if one does exist) of examiner mistakes?

Another reason given for adopting this proposal is to cut down on fraudulent Novice testing. I wasn't aware that there was any great amount of Novice testing fraud. Boy, I'm sure glad the ARRL and W5YI, who obviously consider themselves more honest than you or me, are going to save us from the hoards of illegally tested Novices. Oh...you mean you weren't aware of the thousands of fraudulent Novice licenses granted every year? Gee, now that you mention it, this is the first I've heard of it, too. (Let us not forget that the only testing fraud in recent memory was

perpetrated by duly authorized VEs.)

If no problem exists, then it follows that the ARRL and W5YI must have some other motive behind this nonsense. I haven't a clue why W5YI would support this proposal, unless it's part of some deal that is yet to be disclosed between Maia and the ARRL. I admit that this is pure speculation on my part, but I can think of no other reason why an otherwise intelligent guy like Fred Maia would back such an idiotic proposal.

The ARRL's motives are more apparent. They are the same motives that guided the ARRL when they wanted to control all licensing by being the only authorized VEC (luckily, the FCC kept that from happening). They are the same motives that made the ARRL suggest that they handle all special call sign allocation. When the FCC said they wouldn't mind having a program like the VEC system handle special call sign requests, but that the ARRL was not going to get a monopoly, the League backed off and made the FCC look like the bad guys. Once again last fall, the ARRL's motives became clear when—without notifying their members, or the entire population of American hams they say they represent—they had wording added to an FCC funding bill that would give them exclusive power to assign special call signs to radio clubs. (Coincidentally, it was W5YI who blew the whistle on the ARRL's sneakiness. Hmmm... that might lead some to wonder if we'll be seeing a joint ARRL/W5YI call sign allocation proposal in the near future.)

Can anyone question what the ARRL's prime objective is in proposing to get Novice testing out of the hands of your average ham? Don't you see a pattern here, folks? For the last 25 years, the ARRL has consistently and systematically tried to become the sole governing and regulatory authority for American amateur radio. If the ARRL was capable of acting in the interests of amateur radio, I'd be the first in line to give them more power and authority. But the League has proven time and again, by their own actions, that they are not concerned as much with the hobby of amateur radio and the concerns of the average ham as they are with their own self-serving agenda and self-perpetuation.

I urge you to write to the FCC in Washington and voice your opposition to this proposal. While you're at it, why not drop a line to the boys in Newington and let them know that the majority of American hams are happy with the way the Novice license test is administered.

Instead of creating a transparently obvious paper tiger out of Novice testing, why doesn't the ARRL spend some of its sizeable bank account to help educate the country—especially youngsters—on what amateur radio is, how much fun it is, and how to get involved? Until they do, the majority of hams in this country won't have anything to do with them.

This Novice testing proposal is just another piece in a long line of evidence that shows the ARRL is more concerned with what is good for the ARRL than with what is good for amateur radio. **73**

PROPAGATION

Jim Gray W1XU

Jim Gray W1XU
210 East Chateau Circle
Payson AZ 85541

In general, you can expect July to be a month of reasonably good conditions on the HF bands, with minor disturbances centered around the 9th, 17th, 22nd and 25th...leading to Fair or Good-to-Fair conditions. You can expect considerable short-skip opportunities during the daytime hours on bands between 20 and 10 meters. DX this month will experience the usual summertime slump, although most HF DX bands will be open during daylight hours, and usually until dark, with the highest frequencies dying first, followed by 20 meters last. Then, during hours of darkness, the bands between 160 and 30 meters will tend to come alive. The "top" band (160 meters) will be best between local midnight and 6 a.m. for DX contacts and contacts around the U.S.A. Eighty, 40 and 30 meters will be best in evening and early morning hours. Notice that we don't anticipate any "Poor" conditions in July. Thunderstorms, typical of July, will cause considerable

crash-static interference on the bands below 20 meters... some of which will be unstable during stormy periods. You can expect thunderstorm QRN to block out signals when the storms are located between your QTH and that of the station you are trying to work.

"Sporadic E" propagation via "floating" ion clouds in the E-layer of the ionosphere will provide extremely strong signals from time to time during the month on the frequencies between about 20 meters and 10 meters...possibly even 6 meter openings...on some Good days during the month. Sporadic E results in contacts of up to 1,000 miles or so, and is characterized by signals that last from a few minutes to as

much as half an hour or so, with almost instantaneous fade-out.

Watch the charts for the best times, bands and directions for your DX efforts, and also look for WWV reports on current conditions and trends at 18 minutes after any hour. July should be a Good month in General—as summer-time conditions go—but of course can't be compared with spring and fall conditions. Enjoy this generally quiet and uneventful month for portable and mobile operation, too. It's a winner. **73**

EASTERN UNITED STATES TO:

GMT:	00	02	04	06	08	10	12	14	16	18	20	22
ALASKA	—	—	—	—	—	—	20	—	—	—	—	—
ARGENTINA	20	20	20	20	400	400	—	—	—	—	10	15
AUSTRALIA	—	—	—	20	20	400	200	200	—	—	—	—
CANAL ZONE	15	20	20	—	—	—	20	20	20	—	100	15
ENGLAND	20	—	7/16	7/16	—	—	—	—	—	20	20	20
HAWAII	150	20	20	20	400	400	—	—	—	—	—	150
INDIA	200	200	—	—	—	—	—	—	—	—	—	—
JAPAN	—	—	—	—	—	—	20	—	—	—	—	—
MEXICO	15	20	20	—	—	—	20	20	20	—	100	15
PHILIPPINES	—	—	—	—	—	—	200	—	—	—	—	—
PUERTO RICO	15	20	20	—	—	—	20	20	20	—	100	15
SOUTH AFRICA	—	40	40	200	200	—	—	—	—	—	200	200
U.S.S.R.	20	7/16	7/16	—	—	—	—	—	—	—	20	20
WEST COAST	40	80	—	—	—	—	20	20	20	15	40	—

CENTRAL UNITED STATES TO:

ALASKA	—	—	200	—	—	400	—	20	—	—	—	—
ARGENTINA	7/16	7/16	20	400	—	—	—	15	15	7/16	—	—
AUSTRALIA	150	150	7/16	20	20	400	20	20	—	—	150	150
CANAL ZONE	20	20	20	400	400	—	20	20	7/16	15	100	100
ENGLAND	20	—	400	400	—	—	—	—	—	—	20	20
HAWAII	15	15	20	20	20	400	20	20	—	—	—	150
INDIA	200	200	—	—	—	—	—	200	200	—	—	—
JAPAN	—	—	200	—	—	400	—	20	—	—	—	—
MEXICO	20	20	20	400	400	—	20	20	7/16	15	100	100
PHILIPPINES	—	—	—	—	—	—	200	200	—	—	—	—
PUERTO RICO	20	20	20	—	—	—	20	20	7/16	15	100	100
SOUTH AFRICA	—	400	200	200	—	—	—	—	—	—	—	—
U.S.S.R.	—	—	—	—	—	—	200	200	—	—	—	—

WESTERN UNITED STATES TO:

ALASKA	—	—	—	20	20	200	400	200	200	—	—	—
ARGENTINA	15	200	20	20	—	—	—	—	—	—	15	—
AUSTRALIA	15	15	15	20	20	20	7/16	40	7/16	—	—	—
CANAL ZONE	100	15	20	20	400	400	—	20	20	—	15	100
ENGLAND	20	20	200	—	—	—	—	—	—	—	—	200
HAWAII	15	15	7/16	20	20	7/16	7/16	—	—	—	150	15
INDIA	—	—	200	200	—	—	—	—	—	—	—	—
JAPAN	—	—	20	20	200	400	200	200	—	—	—	—
MEXICO	100	15	20	20	400	400	—	20	20	—	15	100
PHILIPPINES	—	—	—	—	—	—	200	200	—	—	—	—
PUERTO RICO	100	15	20	20	400	400	—	20	20	—	15	100
SOUTH AFRICA	—	—	—	—	—	—	200	200	—	—	—	—
U.S.S.R.	200	200	200	—	—	—	—	—	—	—	—	—
EAST COAST	40	80	—	—	—	—	—	—	20	20	15	40

Note that a (Z) will indicate a difficult path. Try on days when the geomagnetic field is quiet (Q) and when solar flux is 100 and greater.

JULY 1992

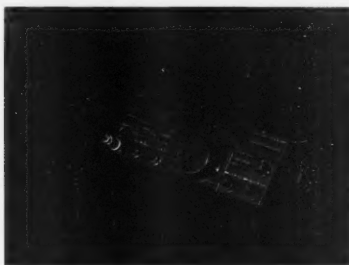
SUN	MON	TUE	WED	THU	FRI	SAT
			1	2	3	4
			G	G	G	G
5	6	7	8	9	10	11
G	G	G-F	G-F	G-F	F-G	G
12	13	14	15	16	17	18
G	G	G	G-F	G-F	F-G	G
19	20	21	22	23	24	25
G	G	G	G-F	G-F	G-F	F
26	27	28	29	30	31	
F	F	F-G	G	G	G	

FT-890AT... Light Years Ahead.

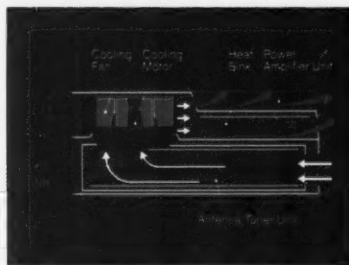
World's Smallest With Built-in Antenna Tuner



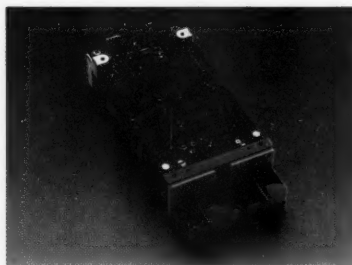
Rear Panel: Seldom used controls are located on rear panel allowing clean uncluttered front panel design.



Mobile Installation: The compact design and built-in antenna tuner makes the FT-890 a great mobile companion, using the optional mounting bracket kit (MMB-20).



DFCS (Duct Flow Cooling System): This unique system allows 100% duty cycle on FM and RTTY for up to 30 minutes of continuous transmission.



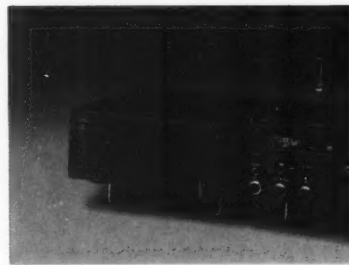
Antenna Tuner: High speed with 31 memories automatically stores most recent antenna matching settings for instant recall while changing operating frequencies.

Superior Performance

The FT-890 is an extraordinary achievement, featuring DLT (Digital Linear-phase Tuning) for silky smooth tuning. Including the advanced RF Front End design of the FT-1000 for superior receiving performance. Compare the advantages for yourself, it's ready to go when you are! Call your nearest Yaesu dealer for one of the best DX-pedition radios ever.

YAESU
Performance without compromise.SM

Specifications subject to change without notice.
Specifications guaranteed only within amateur bands.
One Year Limited Warranty on all Amateur Products.



Radio & Matching Power Supply: The FT-890 is ideal for home, mobile or field use with the optional power supply. Significantly smaller and lighter than competing units.

© 1992 YAESU, 17210 Edwards Road, Cerritos, CA 90701

KENWOOD

New Handheld Horizons

TH-28A/TH-48A

▼ Dual receive with single band HT

TH-28A - RX 118-173.995 MHz (main), 438-449.995 MHz (sub)
TX 144-147.995 MHz

TH-48A - RX 438-449.995 MHz (main), 118-173.995 MHz (sub)
TX 438-449.995 MHz

▼ TH-28A: 2.5W, TH-48A: 2W. Both models 5W output with PB-14, PB-17, or ext. 12VDC

▼ 40 Full function memory channels, expandable to 240 with optional ME-1

TH-78A

Dual frequency receive in any combination.
VHF-UHF, or VHF-VHF, or UHF-UHF

RX 118-173.995 MHz, 438-449.995 MHz
TX 144-147.995 MHz, 438-449.995 MHz

VHF 2.5W, UHF 2W, or 5W output
with PB-14, PB-17, or ext. 12VDC

50 Full function memory channels, expandable
to 250 with optional ME-1

Full duplex cross-band (telephone-style) operation

Additional Features:

TH-28A/TH-48A/TH-78A

Alpha numeric memory channel display.
Specify memories by call sign, name, etc.

Alpha numeric message paging

CTCSS Encode/Decode built-in

Ten 15 digit DTMF autodial memories.

A.B.C.D.*# can also be memorized

Direct keyboard or rotary knob frequency entry

Remote control speaker microphone - SM-33 (optional)

Clock/Timer with alarm

FREE
SMC-33 Speaker
Microphone with purchase!
A \$49.⁹⁵ retail value.
See your Kenwood dealer
for details.

KENWOOD U.S.A. CORPORATION, Communications and Test Equipment Group, P.O. Box 22745, 2201 E. Dominguez Street, Long Beach, CA 90801-5745
KENWOOD ELECTRONICS CANADA, 8676 Keele Road, Mississauga, Ontario, Canada L5T 1S8

Modelable TH-78A's and CAP operation, permits retransmit. Kenwood meets or exceeds all specifications. Contact your dealer for a complete listing of
types, features, and accessories. These features are subject to change without notice. *Consultant service manuals are available for all Kenwood transceivers
and most accessories. One year warranty in the U.S.A. only.

KENWOOD

Pacesetter in Amateur Radio

